Concrete

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Continuous Shoring

Speeds Work on

Tall Chicago Structure

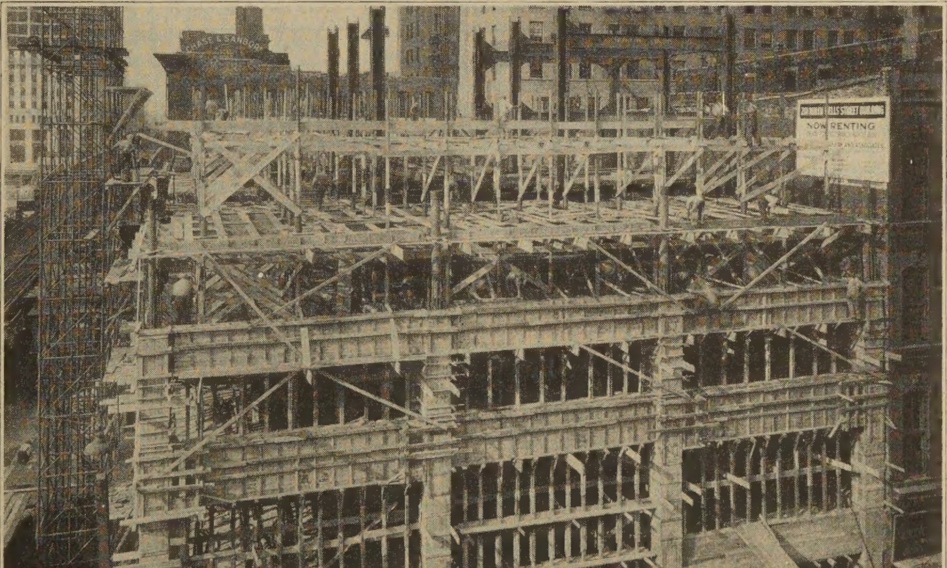
Form Work, Based on Use of Continuous Shoring on 30-Story Chicago Building, Speeds Up Construction Operations

By C. W. ELLSWORTH and H. S. KELLER
Form Consultants, Chicago

PERHAPS one of the most interesting buildings from the point of view of its form work, being erected in Chicago at the present time, is the 201 No. Wells St. Bldg. at the northeast corner of Wells and Lake Sts., for the Trustees System Service by the McLennan Construction Co. from plans by Thielbar and Fugard, architects, and James B. Black, structural engineer.

The building covers the full size of the lot to the twenty-first floor, where it sets back at each floor until the 24th, which is the first floor in the tower proper. This, in turn, sets back at the corner of each floor to the 30th floor. From this point to what would be the 32nd, the roof is stepped back in the form of a pyramid. The design entails some unusual form work problems, some of which are described in this article.

The framework around the elevators is structural steel up to the 21st floor and from the 30th to the apex of the pyramid. Throughout the first eight floors and in scat-


NOW RENTING
NO. P-1493 TAKEN Sept-4-192
BUILDING Trustees Systems Se
ARCHITECTS Thielbar+Fugard
McLENNAN CONSTRUCTION COMPA

Progress view of the Trustees Service System building, Chicago, under construction, showing the methods of form work described in this article

Illustrated particularly is the method of placing continuous shores tered portions of the upper floors, cast iron cores were used in the concrete columns for the purpose of reducing the cross sectional area of the columns.

Continuous Shoring Used

The general contractor, the McLennan Construction Co., wished to put this building up with the greatest possible speed, and with this in mind, their superintendent and the form detailers, laid out the job for continuous shoring.

Continuous shoring is not new, and has been used by this contractor on a number of smaller reinforced concrete jobs, and on all structural steel jobs erected by them. But this job is the biggest one to use this system in Chicago, to date.

To those not familiar with this system, the accompanying sketches and descriptions, will be found helpful.

Form Details

By examining a typical floor plan (Figure 1), the location of joist bottoms was determined and from this floor, locations of continuous shores could be spotted and projected down to the basement, taking care to miss all joists or any other structural member.

On the rough excavation of the basement floor, doubled mud sills were laid as a foundation for the 4 by 4 in. shores. These were run up above the elevation of the finished first floor. They were laid out on approximately 6 ft. centers in one direction and 9 ft. centers in the other They were then braced as shown in Figure 2.

The stringers were spiked to the shores at the required elevation and then the first floor was formed.

By using this system the order of forming was reversed, as the slab and beams were formed first and the column forms were erected last. In order that this might be done accurately, a base line was established and all measurements were taken from this line.

While the work of forming the first floor was in progress, additional lengths of 4 by 4 in. shores were spliced to

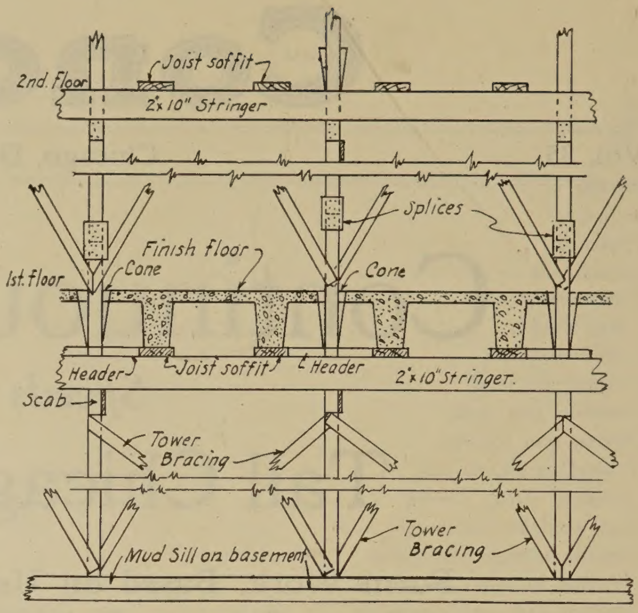
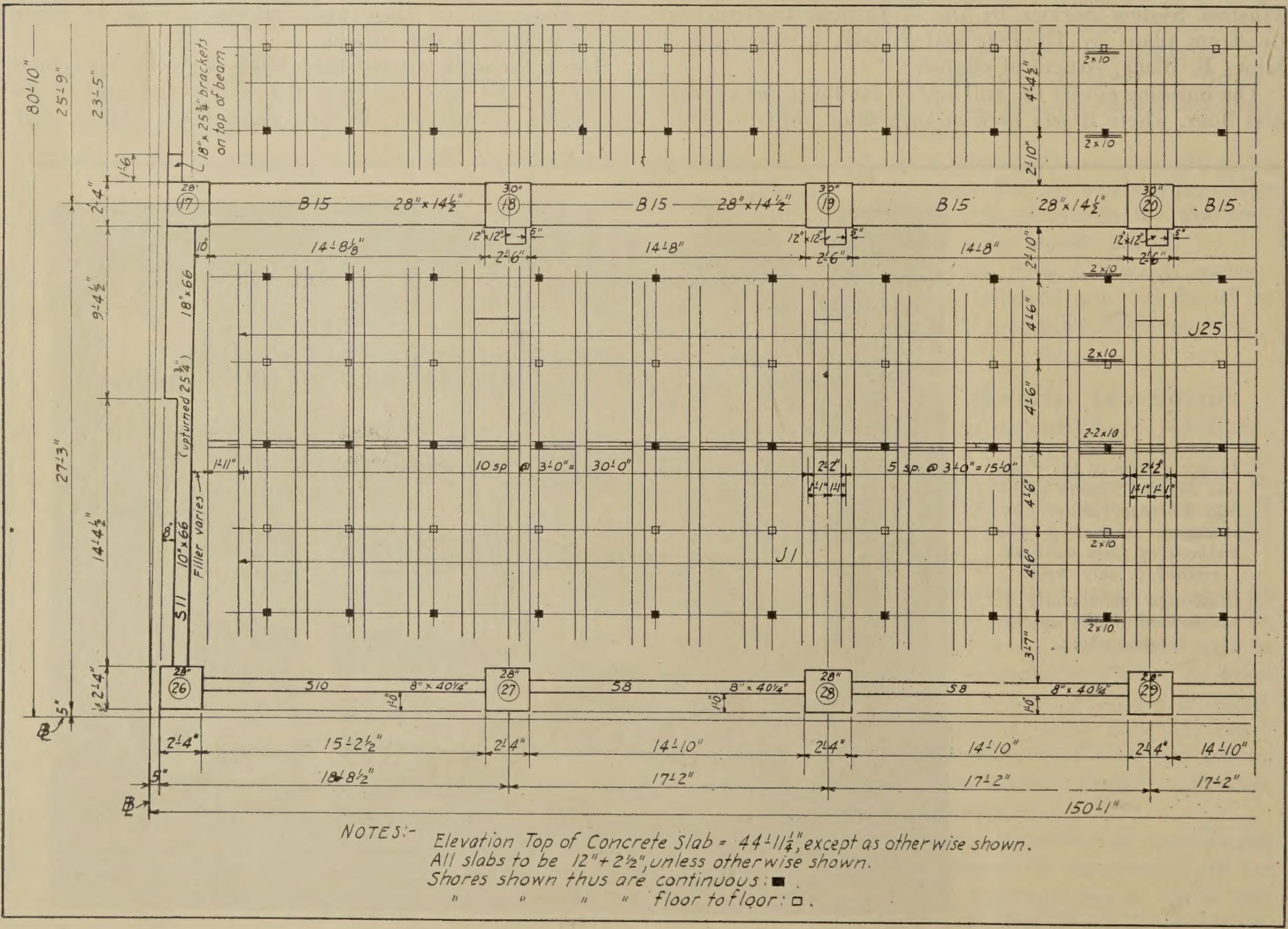


Figure 2. Cross section of one of the floors showing methods of form erection and shore bracing



NOTES:- Elevation Top of Concrete Slab = 44'-11¼", except as otherwise shown.
All slabs to be 12"+2½", unless otherwise shown.
Shores shown thus are continuous: ■.
" " " " floor to floor: □.

Figure 1. A typical joist layout plan, showing location of continuous shores

those extending through this floor and the bracing put in place. Work was then carried on, on the second floor. This was repeated to keep two floors ahead of the concreting.

Here it might be well to speak of the method used in forming around the shores at the floor line. Between the soffit boards of the joists, at the point where the shore came, a header was thrown in, exactly the same as would be used for any electrical ceiling outlet.

Sheet metal cones about 6 in. in diameter at the smaller end, and 8 in. at the larger, were slipped over the shore, small end down and fastened to the header. Just before concreting, the void between the inside of the cone and the shore was filled with sand. This allowed for the easy removal of the shore and it was a simple matter to remove the cone and patch the hole in the floor. There was a 3/4 in. topping to be placed later so no patches appeared in the finished floor.

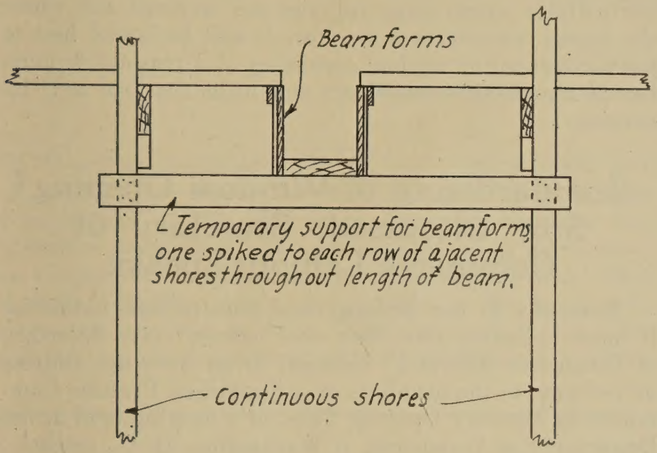

Beam forms
Temporary support for beamforms one spiked to each row of ajacent shores throughout length of beam.
Continuous shores

Figure 3. Cross section showing method of framing beam forms

Wherever a drop beam occurred, stringers were spiked across the two adjacent lines of shores and the beam bottom carried on them, until the floor below was poured and the T-shores could be placed under it.

After a floor was poured, the column sides were set up, and the shores, which extended one story only, were placed. About 50 per cent of the shoring was continuous and the remainder ordinary straight, T, or L as the case might be.

Reusing the Shores

As the work advanced on up through the building, and the lower floors had attained strength, it was possible to remove the lower continuous shores and reuse them above.

This is done by spiking 2 by 10's to the bottom of the shores at the floor line and in this way, the lower floors all take their share of the load above.

Figure 2 shows the use of tower bracing. This was only used in high stories on this job, but can be used throughout if desired.

Eighty per cent of the spandrels were up-turned and, by bracing the inside top side of the forms to the nearest row of continuous shores, which were approximately 4 ft. away from the spandrel, the customary problem of bracing was solved at the start.

Road Builders Assure Program of Wide Interest

The first event scheduled for the American Road Builders convention and road show at Atlantic City, New Jersey, in January, is as in previous years, the distributors' and manufacturers' preview, on Saturday, the 11th.

On Monday, President Frederic A. Reimer will open the exposition with appropriate ceremonies before the general session, with a program of broad interest. Registration will take place during the forenoon. The road show will be closed during the general session on Monday and again on Wednesday morning.

A Monday noon luncheon will be followed by the organization of a Pan-American finance committee. In the afternoon sessions for city officials, county highway officials, contractors and the lien law committee will get under way. The Pan-American division will meet late Monday at Pan-American headquarters in the Ambassador Hotel.

The committees on subgrades and pavement bases, municipal airports and grading, will meet the morning of the 14th and the city, county and contractors' groups will meet again Tuesday afternoon.

Wednesday morning and afternoon the general sessions will mark Pan-American day, with speakers from most of the Latin nations, who will tell of road building progress.

The popular equipment and finance committees will assemble Thursday morning, with national authorities on both subjects presenting papers, followed by general discussion of the committee problems.

State and county highway officials will meet at luncheon Thursday. The city and county divisions and the grade crossings committee will meet in the afternoon.

New Series of Form Articles

Beginning in the January issue, CONCRETE will publish a series of form articles covering practically the entire range of form problems presented by most construction projects. These articles will be based upon practices developed by an outstanding contractor of concrete construction.

The series will include the following subjects:

(1) *Footings.* Details of form work showing methods of assembly and form removal.

(2) *Columns.* Details of form work for typical interior columns of rectangular, octagonal and round sections.

(3) *Beams and Girders.* Details of form work, methods of erection, shoring and removal.

(4) *Flat Slabs.* Interior and exterior floor bays showing details of erection, shoring and removal.

(5) *Flat Slabs.* Details showing methods of dealing with drop panels.

(6) *Columns.* Details of form assembly, erection and removal.

(7) *Panel Walls, and Spandrel Beams.* Methods of assembly, erection and removal.

(8) *Vertical Shafts or Towers.* Special details involved in work of this kind.

(9) *Miscellaneous Form Work.* Details of form work for miscellaneous construction such as stairs, sills, copings and similar parts of buildings.

When Concrete "Sweats"

Why Concrete Walls and Floors Sweat—How to Prevent Sweating

FREQUENTLY we are asked to explain the presence of moisture on the inside surfaces of concrete walls and concrete floors where there are no signs of leakage. Similar conditions occur on stone and other masonry and may be particularly bad on corrugated metal siding and roofs. If the structure is properly built, this moisture does not come through the walls or floors, but is caused by the condensation of moisture on the surfaces that are affected.

The amount of condensation thus caused varies with the temperature of the wall or floor, the temperature of the room and the amount of moisture present in the air. In a room containing warm, moist air, condensation will usually occur if the inner wall or floor surfaces are cooler than the surrounding air.

How to Prevent Condensation

Condensation may be prevented under ordinary circumstances where high humidity conditions do not exist by insulation. This insulation helps to keep the wall or floor at the same temperature as the air in the room. Consequently, the moisture in the air does not condense. Where high humidities exist inside of buildings as the result of manufacturing processes (e. g., laundries, paper mills, etc.), insulation alone may not be sufficient to prevent condensation but must be supplemented by artificial ventilation or special heating systems or both.

Where there is danger of condensation and where its presence is undesirable, concrete and masonry walls should be furred and plastered. The air space thus provided generally gives sufficient insulation to maintain the temperature of the inside wall or floor surface above the point at which moisture will condense on it.

Insulating Floors

In the case of floors subject to condensation, they may be insulated by placing the concrete on a 6-in. fill of well-drained cinders.

If the concrete slab does not come in contact with the ground and the under side is exposed to low temperature as in a refrigerator, and the upper surface is at ordinary room temperature, it will be necessary to insulate the under side with four to six inches of cork or cellular concrete depending, of course, upon the temperatures involved.

Ventilation Advisable

In extreme cases, such as in paper mills and laundries, it is advisable to have an efficient system of ventilation. Moisture must be removed from the room as fast as it is formed by changing the air at frequent intervals. The number of air changes required is dependent upon the amount of water evaporated per hour and the room temperature. The higher the temperature of the air in the room, the greater its capacity to hold water and, therefore, the less frequently it will be necessary to change the air. It is well to bear in mind that a good many rooms of this character are not properly or efficiently ventilated.

Combining Three Factors Effectually

The three factors—air changes, room temperature and floor and wall insulation—can be combined in various ways to prevent condensation.

Since it is not economical to change the air frequently, particularly where large volumes are involved and where the intake temperatures are low, it will be found best to use a combination method consisting of a reasonable number of air changes and floors and walls that are well insulated.

Standardizing of Window Opening Size Discussed; Secretary of Commerce Lamont Speaks

"Economy in the building and construction industries is more necessary now than ever before," says Secretary of Commerce Robert P. Lamont, in an informal address of welcome to the members of a Simplified Practice Committee on Masonry Opening Sizes, at a meeting held at the Department of Commerce, at Washington, D. C., recently, under the auspices of the Division of Simplified Practice, National Bureau of Standards, Department of Commerce.

Outlining the services which the Department of Commerce has to offer the industries in the matter of the elimination of industrial waste and making for better economy in building operations, Mr. Lamont stated that, "It is often necessary for the component elements of an industry to compromise on questions of minor importance in order that they may effect simplification or commercial standards programs which will be of benefit to the whole industry, as well as to the entire country." Mr. Lamont further stated that "the Department of Commerce, through its Division of Simplified Practice of the Bureau of Standards, is ready to support industry on any program that meets with the approval of the majority of that industry."

Brick Key Unit

It was the consensus of opinion of those present, in discussing the subject of a standard unit dimension for masonry, that the fundamental or "key" building unit was embodied in the brick. It was accordingly suggested that a brick plus a mortar joint be established as a unit of measure, the length of the brick to equal a unit minus one joint; the width one-half unit minus one joint; and the thickness being one-third unit minus one joint. For the purpose of these considerations a mortar joint was taken to equal one-half inch.

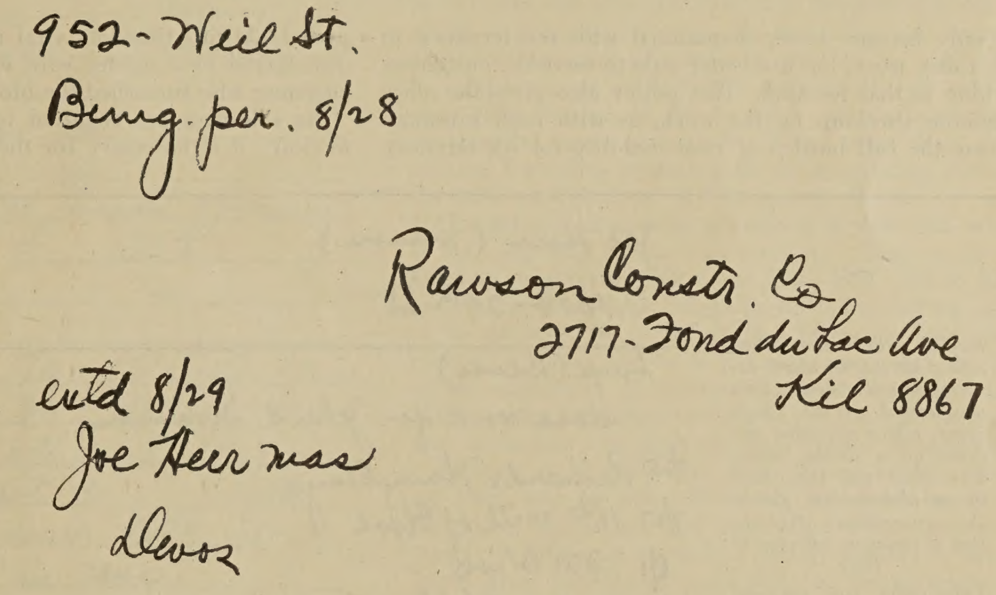
LeRoy E. Kern, representing the American Institute of Architects, who was elected chairman of the Simplified Practice Committee, announced that he will shortly appoint a sub-committee, which will consist of one representative each from the Face Brick Manufacturers, the Common Brick Manufacturers, and the Associated General Contractors of America. It will be the duty of this sub-committee to prepare a report in the form of a recommendation as to some standard dimensional unit, such as suggested at the conference held in Washington. This recommendation, necessarily tentative in its nature, will subsequently be referred to all those interested in the subject for their consideration and criticism.

Selling 6,000,000 Block

How Can Four Men Sell an Average of a Million and a Half Block Each?—The Sales Methods Adopted to Attain That End Are Described in This Second Article on the Activities of the Milwaukee Concrete Products Co-operative Association

By "SPEC" COLLINS
Manager, Milwaukee Concrete Products Co-Operative Association

TO sell approximately six million concrete block in a year's time—that is the problem confronting the sales organization of the Milwaukee Concrete Products Co-operative Association. This task is allotted to four men—an average of a million and a half block per man. That is quite a healthy quota, but, providing the business is there, they propose to do it. These men are tackling the task of co-operative selling with a confidence that makes veteran salesmen wonder. Fortunately they are veterans themselves. That may account for a large measure of their confidence. Starting at scratch this group of men have developed a business that, after three months' work, already has over 600 active accounts that they are following.



952 - Weil St.
Bung. per. 8/28

Rawson Constr. Co
2717 - Fond du Lac Ave
Kil 8867

extd 8/29
Joe Herr mas
Devos

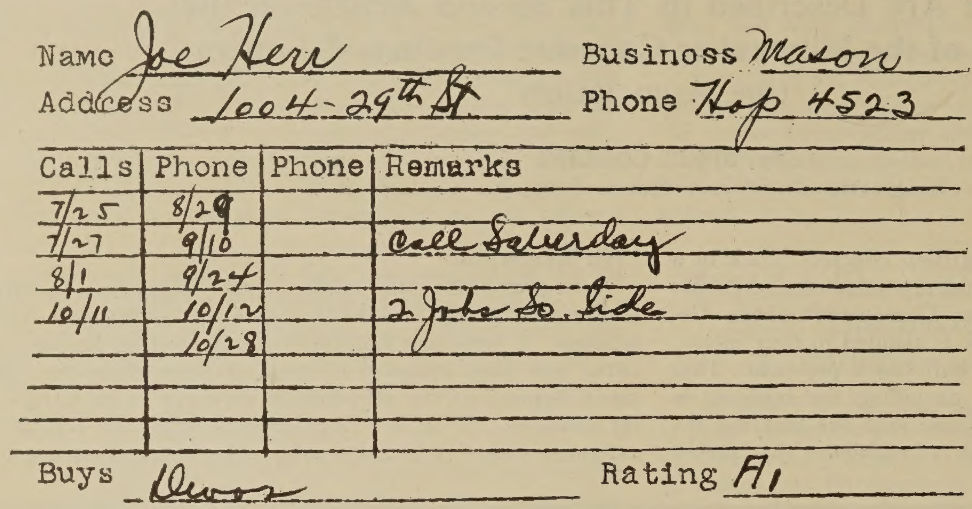
The local building newspaper carried the fact that a bungalow permit had been issued for the Rawson Construction Co. The salesman checking the job found that Jos. Herr was to do the mason work. The job was excavated on the 29th. Herr was contacted and the order "landed." Herr wished block from the Devos plant

And how is this being done? That is what follows. When the Co-operative took over the sales problems of twenty-two Milwaukee County manufacturers, it immediately set out to collect credit information on their customers. It was on this credit showing that they based their contacts and the amount of energy to be expended in the direction of certain potential customers. This list was immediately supplemented by a list of customers of plants outside of the association so that in their efforts the salesmen of the association would pass by no possible outlets for member products.

"Hit Every Job"

A careful study was made of the Milwaukee County market and it was decided to divide the county into four sections. A salesman familiar with the section he was to cover was then assigned to each of these divisions and made responsible for all construction work in his particular territory. No matter how large or small the job, this salesman makes it in his rounds. His instructions are to "hit every job." Whether the job be a small garage or a large office or factory building it is his duty to find out if there is some possible use for concrete building units. It is the contention of the association that there is an outlet for concrete building units in every building and that it is the duty of the salesman to find this. And it has been surprising the number of places that concrete block has gone into where, if no effort in development had been spent, some other material might have been used. A veteran clay tile salesman called at the office recently to pay his compliments to the association sales force. "I take off my hat to your boys," he said. "I had them licked forty ways on price, but they put the job across in spite of me." Incidentally this job was an item of some thirty to forty thousand units.

It is surprising how small an amount of duplication of effort on the part of salesmen the zoning of territory makes. Occasionally a salesman has a personal friend, a contractor, erecting a job outside his territory. He does not follow him into this territory, but sends word by the man in that territory that he wants the job booked through the association, or, by phone he books the order and turns it over for servicing to the man who makes that job in his rounds. By keeping to a certain set territory the salesmen not only become better acquainted with the territory in which they work, but are better able to serve the customers working in that location. This policy also gives the office a definite check-up on the work, as with each salesman sharing the full burden of responsibility for his territory there can be no shifting of the burden of blame if a job gets away.

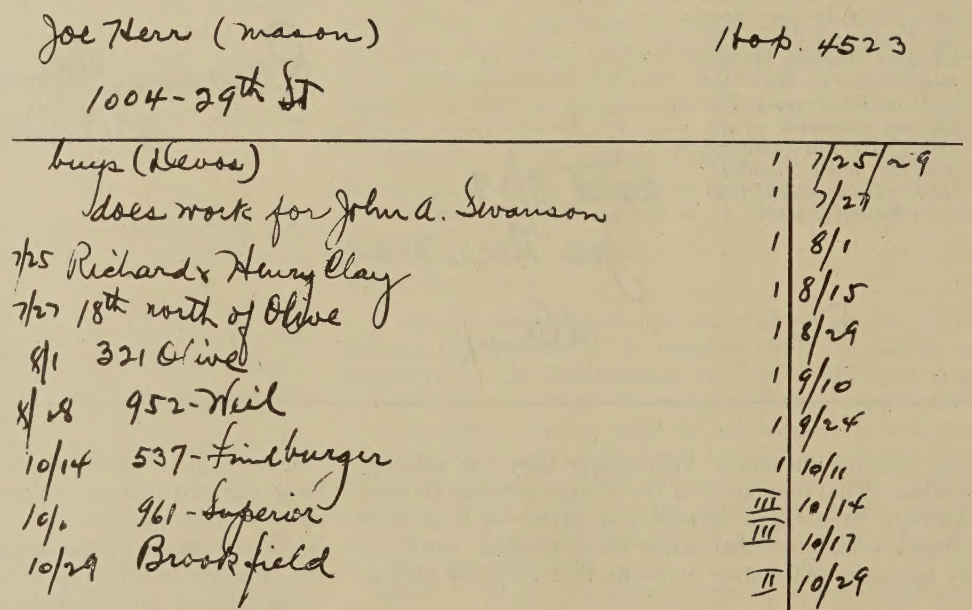


Name Joe Herr Business Mason
Address 1004-29th St. Phone Hop 4523

Calls	Phone	Phone	Remarks
7/25	8/29		
7/27	9/10		Call Saturday
8/1	9/24		
10/11	10/12		2 Jobs So. Side
	10/28		

Buys Devos Rating A1

Each salesman has approximately 250 cards like this on which he keeps track of his calls, phone or personal, on customers



Joe Herr (mason) Hop. 4523
1004-29th St

buys (Devos)
does work for John A. Swanson
7/25 Richard & Henry Clay
7/27 18th north of Olive
8/1 321 Olive
8/8 952-Weil
10/14 537-Fineburger
10/1 961-Superior
10/29 Brookfield

1	7/25/29
1	7/27
1	8/1
1	8/15
1	8/29
1	9/10
1	9/24
1	10/11
III	10/14
III	10/17
II	10/29

Herr's order was then taken on the standard association order sheet. This was called to the Devos plant, which recorded the order on a similar sheet. The order was then filed in an alphabetical file in the association office so that it could be referred to later

This order was received over the telephone on the evening of August 29th and was phoned to the plant that was to make delivery on the morning of the 30th

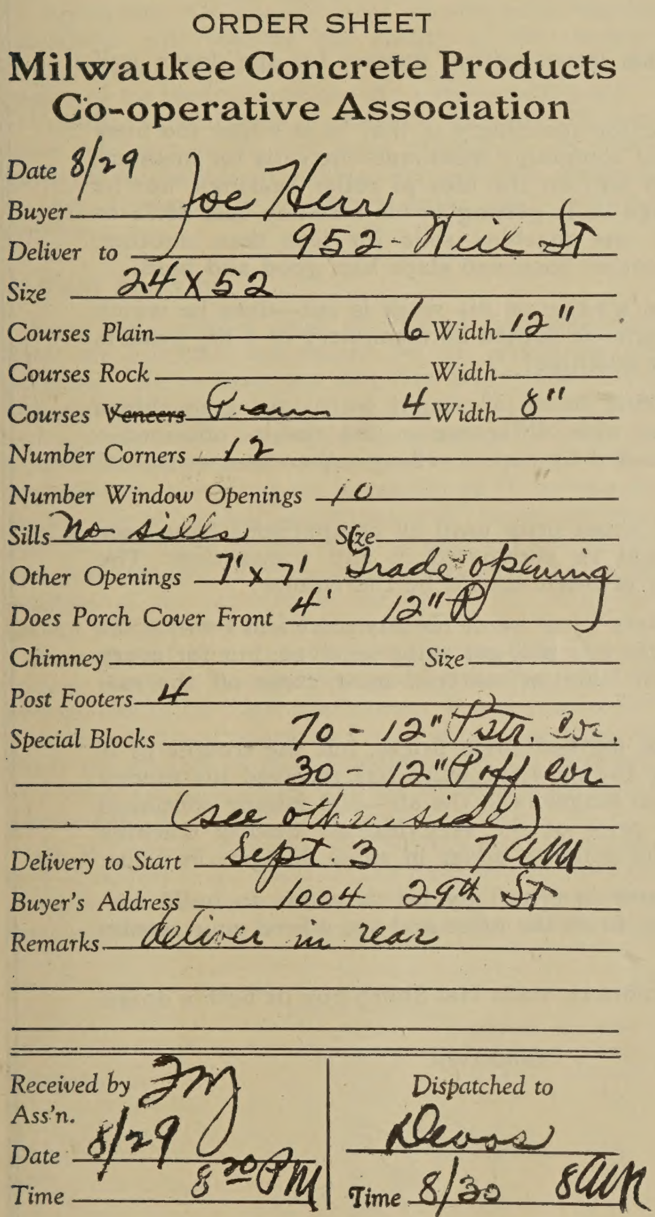
Securing Prospects

In Milwaukee County we have two splendid local publications covering the building field. Each of these publishes daily the permits issued the day before in the city of Milwaukee and at least three times a week the permits issued in outlying communities. As each permit comes out it is listed by the salesman, together with any pertinent information he may have on the job, on a three by five white card. These cards are worked into rotation or a route before the salesman leaves the office and are, as far as possible, his working schedule for the day. These cards are carried by the salesmen until the job is completed. At this time any vital information they contain is transferred to a master card containing the name of the customer who furnished the block.

As salesmen are required to service all jobs in their territory it is necessary for them to carry the cards until the job is completed. This servicing consists of watching the job to determine whether or not material is being delivered so that there is no delay afforded the contractor, the condition of the material as it is delivered, the ordering of any special shapes or sizes and the determination as to whether there are changes made as it progresses. This servicing is a mighty important part of the general sales scheme as it develops a friendliness among contractors that leads to subsequent sales.

Building papers are by no means the only leads used in securing prospects. By far the greater number of customers of the association are mason contractors and these men are followed up consistently by phone or on the job to see whether or not they have any future work that may lead to a sale by the association. General contractors, builders, designers, architects and building and loan associations are also contacted to secure information on any prospective work that may come up.

As yet the association has done little promotional work. What work of this nature it has done has been directed toward work coming up in the immediate future and has not been what might be termed long range promotion.



ORDER SHEET

Milwaukee Concrete Products Co-operative Association

Date 8/29
Buyer Joe Herr
Deliver to 952-Neil St
Size 24 X 52
Courses Plain 6 Width 12"
Courses Rock Width
Courses ~~Veneers~~ Gran 4 Width 8"
Number Corners 12
Number Window Openings 10
Sills No sills Size
Other Openings 7'x7' Trade opening
Does Porch Cover Front 4' 12" R
Chimney Size
Post Footers 4
Special Blocks 70 - 12" Pstr. Cr.
30 - 12" Poff cor
(see other side)
Delivery to Start Sept. 3 7 AM
Buyer's Address 1004 29th St
Remarks deliver in rear

Received by Ass'n. JM
Date 8/29
Time 8^20 PM

Dispatched to Deoss
Time 8/30 8AM

Herr has already been buying from the association and has a "job card" in the sales manager's file. When this order was received it was, of course, made a matter of record on this card

During the winter months when work on the outside will be slow, an intensive campaign of promotion work will be carried on. It is hoped by this campaign with architects, designers and builders to develop new markets for concrete building units and expand the present markets. At the present time home building in the Milwaukee territory is only about 70 per cent of what it was last year. This has necessitated the selling of more concrete block in factory construction and for stores and apartments. Many of these jobs that previously called for some competitive material are now being swung to block. This is especially true of store and apartment foundations. Either twenty-inch or sixteen-inch foundations are being sold for many of these jobs. These are obtained by combinations of stock units such as eight-inch or twelve-inch blocks.

In addition to being responsible for immediate work, each salesman has a list of practically two hundred and fifty names of prospects, contractors, builders and architects, in his territory. These are contacted, either personally or by phone, at least twice a month. This system gives a fairly complete check-up of all work in prospect and is often the means of booking work far in the future. These contacts are often made at night over the phone, but wherever possible are made personally. The job of selling for the association is distinctly not a "soft" one. Hours are long—the office is open at six in the morning and does not close until six at night. This does not necessarily mean that every salesman is at the office at six, but at least one week a month he is required to be. Then he has his phone calls to make at night, which take from a half hour to an hour and a half.

Once he receives an order the salesman immediately records it on a standard order blank and if it is to be delivered at once he phones it into the office for an O. K. as to credit and allocation and it is dispatched to the plant which is to make delivery. He is not through here, however, for the work of servicing must go on until the job is completed. It is distinctly an outside job. On rainy days calls that could not be made otherwise, such as at contractors' homes, are made. These rainy days, too, are utilized for office routine such as completing records or for calls at architects' and designers' offices.

One thing that may be of interest is that each salesman is held supreme in his own territory. That is, any decisions to customers must come from him. While he may have gone over these things in the office before arriving at his decision, he is the guiding factor in determining a course of action and he is the man who takes the verdict to the customer. If two salesmen or the salesman and sales manager go together on any job the man in the territory is the one who gives the final verdict to the customer.

Outside competition has given the association salesmen no easy row to hoe. However, by good headwork, a boundless enthusiasm and determined effort they are constantly building up not only a goodly number of accounts, but a great amount of good will for the association and the many firms which make it up.

New Book

Tentative Standards

A. S. T. M. Tentative Standards. Published by the American Society for Testing Materials, Philadelphia, Pa.

This 1929 edition has just come off the press and comprises 901 pages. A number of the 173 standards relate to concrete and cement.

The term "Tentative Standard" as used here by the Society as distinguished from "Standard" is applied to a proposed standard which is printed for one or more years with a view of eliciting criticism, of which the committee concerned will take due cognizance before recommending final action toward the adoption of the standard by formal action of the Society.

P. G. RILEY
President

P. G. RILEY
GENERAL CONTRACTOR

~~701 Temple Street, Pittstown, N. Y.~~

T. G. McGOVERN
General Supt.

Los Angeles

Dear Mac:

Well, here is what John Brundage wrote in this letter-writing contest for the dozen golf balls:

"The chief weakness of the buyer of construction machinery is that he is either too busy or too careless to see comparative tests made of competing machines—he calls for instance, for roller bearings, because somebody has sold him on the idea of roller bearings, but he doesn't really know whether the roller bearings he is getting in his machine cost $0.75 or $18.50—he doesn't study out the reasons why one machine sells for less than another, though there usually is a reason, which later comes back and slaps him good and hard.

"A contractor knows what he has to do when a price on his work is cut—does he watch out for a nigger in the woodpile when a low price is quoted on machinery or a big price is offered for his old machine in trade for a new machine?

"Seventeen manufacturers may make a machine to do a certain work—these machines may even look similar, but there is probably a wide difference in the results obtained—the contractor judges value by expectations aroused by expert selling rather than on actual results.

"There ought to be a law against the asking about price until all comparisons have been checked up—in other words, the price tag should be eliminated in any transaction. The seller who comes through with the most points of merit should be the winner.

"I have been a manufacturer of concrete mixers. Just name me any price and I will make you a mixer for that price. If the price is high, you will get value received, but for every dollar you take off the price, a dollar's worth of labor or material must come off the machine and will show in ultimate results.

"There is always a very plausible reason for marked-down prices, but the trouble of it is—those reasons show up unexpectedly, after the cheerful seller has received his money and the odor of his two-for-a-quarter cigars no longer is in the air—and money continues to leak out until eventually you have paid the price of the very highest quality machine made. Yes, you saved a dollar, but it was a lead dollar, a dollar in name, but not in value.

"The buyer names his price—the manufacturer is forced by his demands to build machines for the buyer's price. Keep on beating down the price and see where your results will be."

Well, Mac, the Sec'y of the Chamber of Commerce made Hal Smith buy us both a dozen golf balls, but I think John won his.

Sincerely,

PG

While lunching together recently, P. G. Riley, retired contractor now residing in California, and John Brundage, equipment manufacturer sharing the same fate, met a young contractor friend. In the course of a discussion on the subjects of their two respective fields, the latter suggested that "P. G." put down on paper his opinion of what is wrong with the equipment manufacturers and Brundage express himself about contractors.

Last month "P. G." wrote back home telling his young superintendent Tom McGovern what he had said in his entry in the letter-writing contest. This month he again writes "Mac," quoting John Brundage's opinion of some of the things that ail the purchaser of equipment.

Admixtures in Concrete

An Economic Analysis on the Use of Admixtures in Concrete

By JOHN G. AHLERS
Barney-Ahlers Construction Co., New York

ADMIXTURES are usually claimed to improve the workability and quality of the concrete and technically this is accomplished by overcoming deficiency in the aggregates. Occasional claims are also made that the admixtures will improve the quality of the concrete through chemical reactions; in other words improve the quality of the binding medium—the water-cement paste.

Usually a careful study of available materials will overcome deficiency in the aggregates themselves. In others words, it is possible to combine the available materials in such a way so as to give a dense, easily working concrete.

A Field Analysis

From the practical point of view of the contracting field, the economic advantages are of paramount importance. An analysis has therefore been made of the financial advantages in the use of sufficient admixtures, and a study made by a field organization to bring the basis of comparison to a dollar and cent analysis. This is possible by computing the increased cost of the concrete by the use of various admixtures and considering what may be purchased in the form of portland cement for this same amount of money, and comparing the mixed qualities of the concrete by the use of this additional cement with concrete using admixtures.

As a general rule it may be said that one-half a bag of cement could be bought per yard of concrete for the average cost of the usual admixtures. The use of one-half a bag of additional cement in a yard of concrete improves either the strength or the workability, and has been used as a study for comparison with the advantages gained by admixtures.

As outlined in Professor MacMillan's work, the addition of cement to the water-cement paste will increase the strength and also increase the workability, the aggregates remaining constant. In order to be entirely fair a study has been made, however, assuming that only one-half of the additional cement used is for the benefit of increasing the strength and the remaining portion for increasing the water-cement ratio. The report of our testing engineer—John Fink—from some actual field tests and cost data is given in Table I.

Comparison of Admixtures

The data summarized in the accompanying Table I has been gathered from pamphlets and other articles published by the various manufacturers, testing laboratories, government bureaus, and in the case of calcium chloride, portland cement and admixtures A and B, from original data obtained on actual construction jobs.

The costs of the admixtures have been figured on the basis of six bags of cement per cu. yd. of concrete using a water-cement ratio of 0.9. The cost per pound of the several admixtures will vary somewhat depending on the quantity of material purchased.

The cost of a cubic yard of concrete has been used as $13.50 in figuring the saving due to increased yield.

In the case of admixture A an average saving of about 12 cents a yard is obtained. This admixture makes a decided improvement in the workability of the concrete, but delays the initial set about one-half hour. As admixture A is chemically inert the large amount of water which it absorbs eventually evaporates, leaving a finely divided material in the concrete. This tends to leave the concrete full of numerous fine holes which, however, have less capillary action than the larger holes which would be present if no admixture had been used.

Using admixture B, 11 cents a yard is saved due to increased yield. The initial set is prolonged about 2 hours and the final set about one-half hour. From personal observations the effect of B on the workability of concrete is not nearly as pronounced as A. Admixture B causes a decided decrease in the slump.

TABLE I

Admixture	Recommended Proportions Per Cent by Weight	Increased Yield Per Cent	Increased Slump Inches	Cost Per Pound Cents	Cost Per Cu. Yd. Conc. Cents	Saving Account Bulking Cents	Net Gain* Strength Per Cent	Net Gain* Cost Cents
A	2-4	4.25	½	2.5	30.60	57.3	14.0	27.3 to —2.7
A′	3	—	1	—	37.5	—	—	+19.8
B	3	3.5	—3½	2.0	36.0	47.2	11.6	11.2
B′	3	—	—1½	—	—	—	10.3	—
C	2-4	4.3	0	3.6	43.2-86.4	58.0	4.8	15.0 to —28.4
D	5	2.0	0	1.0	30	27.0	50.0	—3.0
Hydrated lime	10-12	2.6	1	0.7	42-50.4	35.1	—1.5	—6.9 to —15.3
Calcium chloride	2	0.0	0	1.6	19.2	0.0	20.0	—19.2
Portland cement I	8	2.0	1	0.54	26.0	27.0	7.2	1.0
Portland cement II	8	2.0	0	0.54	26.0	27.0	15.5	1.0

Notes:—Six bags of cement figured per cu. yd. of concrete.
I—Half of cement used for increased strength and half for increased water cement.
II—All of added cement used for increased strength..
Strength increase using cement based on 2,200 lb. concrete at 28 days.
A & B—Taken from manufacturers' data.
A′ & B′—Taken from original field data.

A loss of about 7 cents a yard is sustained when admixture C is used, as the gain due to increased yield is not equal to the cost of the admixture.

Admixture D does not swell like the three previous materials, but like cement, occupies a space equal to its own volume. A loss of 3 cents a yard results from using this admixture. The effect on the strength of cement as shown by mortar briquettes is practically nil, but the increase in the strength of concrete at 28 days by using this admixture is claimed to be 50 per cent.

Hydrated lime causes a slight reduction in the strength of the concrete as well as a loss of 11 cents a yard in the cost. The workability and water-tightness, however, are improved.

No bulking is claimed for calcium chloride as it is added in solution form as part of the mixing water. Consequently the cost of the chloride is added to the cost of the concrete. This amounts to 19 cents a yard. Besides this cost must be figured the expense of a man to make the solution and add it to the mixing water. Using 200 cu. yds. as an average day's pour and $8.50 as a man's wages, this added expense amounts to $4.25 a yard. Therefore a total loss of about 23 cents a yard is involved.

The use of calcium chloride greatly accelerates the time of both initial and final set. About 1½ hours are deducted from the time of initial set and about 2½ hours from the final set.

The strength of concrete using 2 per cent calcium chloride by weight of cement is greatly increased, especially at the early ages. After about one month the strength of the concrete is the same as ordinary concrete. There is no noticeable increase in workability when calcium chloride is used.

An objectionable feature of calcium chloride is that if any proportions outside the limits of 2 per cent to 4 per cent are used the strength of the concrete is impaired.

In the use of portland cement as an admixture two cases have been considered. First, using half of the added cement for increased strength and half to allow for an increase of water, thus obtaining a wetter consistency; second, using all of the added cement to provide increased strength and any increase in workability that might occur due to the use of added fine material. In either case a saving of 1 cent a yard results.

The use of portland cement does not give the same effect on workability as admixtures A, B and C because cement as used in concrete is not a true colloid and therefore does not swell and form the jelly-like mass that the three above mentioned materials do. However, as more cement is used than the three admixtures, the water-tightness is increased by filling up more of the pores in the concrete. It should also be remembered that cement is an active element in concrete and does not lie dormant as the other admixtures do.

Conclusions

From the above discussion and the data in the table it appears that admixtures in general do not compare with an equal money's worth of cement. It might be well to inquire further into relative effects of the more promising admixtures and cement on such qualities of the finished concrete as shrinkage, water-tightness, wearing qualities, long time strength, etc.

Southwest Road Show and School in February

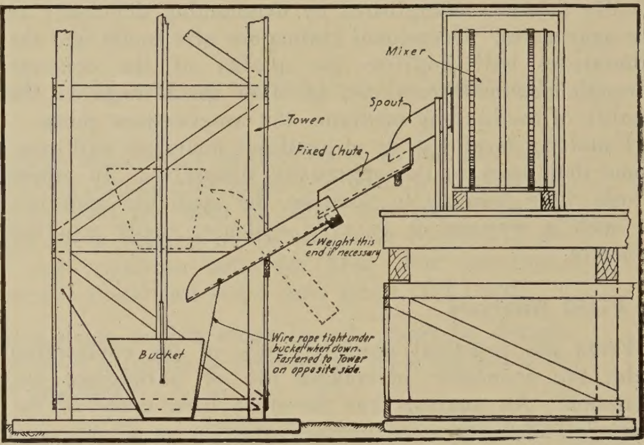
February 25th to 28th, 1930, have been chosen for the holding of the fifth annual Southwest Road Show & School at Wichita, Kansas.

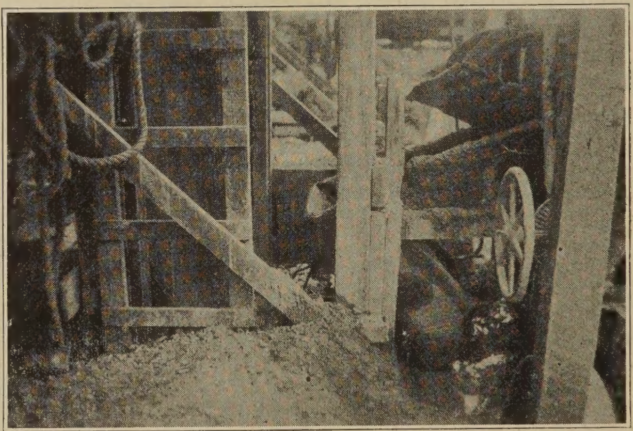
Non-Drip Mixer Chute Saves Labor

By **HARLAN H. EDWARDS, C. E.**
Supervising Engineer, Scripps College, Claremont, California

What is attempted by most contractors yet accomplished by few is operating admirably on the work of the Wurster Construction Company at Claremont, California, where a third residence hall and a combined recitation hall and office structure are being erected for Scripps College. It is a non-drip connecting chute between the mixer and hoist tower bucket.

Instead of the usual fixed chute with a leather or metal flap permitting a portion of each batch to drop down into the bucket hole, usually requiring frequent shut-down-and-shovel-out operations, this arrangement retains all concrete or mortar while the bucket is up and permits discharge only when the bucket is down. It consists of a section of chute about 4 ft. long, pivoted on a rod and counterbalanced so that the instant the bucket starts up, the back or mixer side of the chute drops down, throwing the end normally overhanging the bucket upward, giving several inches clearance for passage of the bucket. The back end is so constructed as to form an angle or pocket which retains the concrete. The front end of the chute is fastened to a rope or cable which in turn passes down into the tower hole under the bucket and is fastened up to a timber on the far side of the tower structure. This cable is so adjusted that the weight of the bucket as it nears the bottom pulls the chute into place for discharging concrete and holds it until the bucket starts up again.


Mixer
Spout
Tower
Fixed Chute
Weight this end if necessary
Wire rope tight under bucket when down. Fastened to Tower on opposite side.
Bucket



Anyone who has experienced the delays and costs attendant on frequent digging out of the tower hole will immediately realize the worth of this arrangement. It was devised by A. Jones, labor foreman, in co-operation with Geo. Smith, superintendent.

The Products Manufacturer Checks Up

What Has 1929 Brought in Profits or Losses?—Here Are Some Simple Methods for Checking Up on the Year's Activities

By F. W. SCHNOEBELEN

AS the year draws to a close, the products manufacturer takes an inventory of his business. But he should not stop at that. He should go one step further and make an *analysis* of his business. This analysis is made from the statements, that is, the profit and loss statement and the balance sheet at the end of the period. It is nothing more than a financial statement, which is a picture of the condition of the business in dollars and cents. It presents the financial facts in such a way that the manufacturer has a more complete understanding of his business. Making up the financial statement is a good habit to get into, for we never know when a crisis will arise in our business, when we will have to call on our bank for credit. If we do not at present make an annual or a semiannual statement for our banker, it is best to commence at once. You will find if you have maintained that personal relation with your bank, that the sailing will be smoother in an emergency.

Not a Difficult Job

It is not a difficult task. If you have any sort of a bookkeeping system it is easily accomplished. It is merely taking the facts from the profit and loss statement and the balance sheet and putting them in such a position that they tell you a story of the business. It is, of course, impossible to illustrate all possible methods of analyzing statements, but some of the more useful statements and methods will be illustrated. To illustrate our method we will use the balance sheet and the profit and loss statement referred to as Exhibit J. 1. and J. 2. respectively, of the Standard Block Corporation of America, a hypothetical corporation.

The first question that should naturally arise in our minds is: has our investment in the business been profitable? In every business of today there is a certain element of risk. Thus it would be unwise to take the risk in business we do unless we receive a substantial profit on our investment, for any good bond will pay 6 per cent without hazard.

Let us return to the earnings of the Standard Block Corporation. From the balance sheet, Exhibit J. 2. we find the capital stock to be $40,000.00 and the net earnings from the profit and loss sheet or Exhibit J. 1. to be $10,000.00

The rate of profit on the capital investment would then be as follows:

$$\frac{\text{Net Profit}}{\text{Capital Investment}} = \frac{\$10,000.00}{\$40,000.00} = 25 \text{ per cent}$$

This means that for every dollar the manufacturer had invested in the business, he received a return of 25 cents on the dollar.

EXHIBIT J. 1

THE STANDARD BLOCK CORPORATION OF AMERICA

Profit and Loss Statement

For the Year Ending December 31, 1929

Gross Sales					$62,800.00
Less—Returned Sales & Allowances				$ 500.00	
Discounts Allowed				1,000.00	1,500.00
Net Sales					$61,300.00
Less Cost of Goods Sold:					
Inventory Finished Goods Jan. 1, 1929				$ 4,000.00	
Add Cost of Goods Manufactured:					
Raw Materials.					
Inventory Jan. 1, 1929		$ 400.00			
Purchases	$23,100.00				
Less—Discts. Earned	1,250.00	21,850.00			
		$22,250.00			
Less Inventory Dec. 31, 1929		200.00	$22,050.00		
Direct Labor			9,000.00		
Manufacturing Expenses			$5,200.00	36,250.00	
				$40,250.00	
Deduct Inventory Finished Goods Dec. 31, 1929				4,775.00	35,475.00
Gross Profit on Sales					$25,825.00
Deduct Delivery & Selling Expenses:					
Delivery Expense				$ 6,000.00	
Selling Expense				2,800.00	3,800.00
Net Profit on Sales					$17,025.00
Deduct Administrative & Financial Expense:					
Administrative & Financial Expense					$ 7,025.00
Net Profit For Year Ending December 31, 1929					$10,000.00

It is also well to know what percentage of the profit we are making on our net sales. From Exhibit J. 1., we find that the net sales are $61,300.00 and the net profit $10,000.00. The profit on the net sales would then be 16.28 per cent, determined as follows:

$$\frac{\text{Net Profit}}{\text{Net Sales}} = \frac{\$10,000.00}{\$61,300.00} = 16.28 \text{ per cent}$$

Ratio of Assets to Liabilities

The next question should be: what is the liquid condition of the business? In other words, is the working capital of the business or the excess of its current assets over its current liabilities? Current assets are cash or its equivalent that can be turned into cash on short notice, while current liabilities are amounts that we owe, which are due or will be due in a short time. This is a very significant factor in determining the solvency of a business, because the ability of a business to meet its current debts as they come due depends to a large extent upon the surplus current assets. The ratio of working capital is of a great importance and is obtained by dividing the current assets by the current liabilities. In Exhibit J. 2. we find that the current assets, which are composed of cash, accounts receivable, and inventories, amount to $22,000.00; while the current liabilities, which are composed of accounts payable, amount to $2,120.00. The current ratio would then be as follows:

$$\frac{\text{Current Assets}}{\text{Current Liabilities}} = \frac{\$22{,}000.00}{\$\ 2{,}120.00} = \$10.37$$

This signifies that the Standard Block Corporation has $10.37 of assets for each dollar of liabilities. Banks usually maintain that a working capital ratio of less than 2 to 1 or less than $2.00 of assets for each dollar of liabilities is an indication of an unsound financial condition.

EXHIBIT J. 2

THE STANDARD BLOCK CORPORATION OF AMERICA

The Balance Sheet Dec. 31, 1929

Assets

Current Assets				
Cash in Bank and on Hand			$ 5,000.00	
Accounts Receivable		$12,625.00		
Less—Reserve for Depreciation		600.00	12,025.00	
Inventories:				
Finished Goods		$ 4,775.00		
Raw Materials		200.00	4,975.00	$22,000.00
Fixed Assets				
Real Estate			$11,000.00	
Buildings		$12,500.00		
Less—Reserve for Depreciation		240.00	12,260.00	
Equipment:				
Factory	$ 9,700.00			
Less—Resr. Depr.	1,800.00	$ 7,900.00		
Automobiles	$ 3,000.00			
Less—Resr. Depr.	600.00	2,400.00		
Office	$ 490.00			
Less—Resr. Depr.	50.00	440.00	10,740.00	
Good Will			5,000.00	39,000.00
				$61,000.00
Liabilities				
Current Liabilities				
Accounts Payable				$ 2,120.00
Fixed Liabilities				
Bonds Payable				8,880.00
Capital				
Capital Stock			$40,000.00	
Surplus			10,000.00	50,000.00
				$61,000.00

Stock Turnover

We should determine next our manufactured stock inventory turnover, which is understood to mean the quotient obtained by dividing the cost of goods sold by the average inventory or the number of times that we have sold out our average inventory during the year. In the concrete products business, it may be computed by using the inventories of finished goods. Frequent turnovers are a sign of a prosperous business, because the profit is made on a smaller investment. In the balance sheet of the Standard Block Corporation we find that the inventory of the finished goods at the end of the year is $4,775.00 and we will assume that this is the average for the year. The cost of the goods sold is taken from the profit and loss sheet. It amounts to $35,475.00. The manufactured stock turnover is then determined as follows:

$$\frac{\text{Cost of Goods Sold}}{\text{Average Inventory}} = \frac{\$35{,}475.00}{\$\ 4{,}775.00} = \$7.43$$

This means that our manufactured stock inventory was turned over more than seven times during the year, or every 51 days.

Unpaid Accounts

It is also desirable to know the length of time the manufacturer permits his accounts to run. This is determined by making an analysis of the accounts receivable. In determining the value of the accounts receivable, the age is an important element. While no accurate statement of their age can be made without an examination of the accounts themselves, the average age and the approximate length of time before collection can be determined. This will show whether the average collection period corresponds with our terms of sales. In Exhibit J. 1 we find that the gross sales are $62,800.00 and on Exhibit J. 2 we find that our accounts receivable are $12,025.00. The collection period is then determined as follows:

$$\frac{\text{Sales}}{\text{Accounts Receivable}} = \frac{\$62{,}800.00}{\$12{,}025.00} = \$5.22$$

$$\frac{360\ (\text{No. of days in year})}{5.22} \doteq 69\ \text{days,}$$

the average for the collection period. This indicates that there are some slow accounts on the books. Many accounts have been paid in the discount period, and when this fact is taken into consideration, it becomes evident that the unpaid accounts must be more delinquent than 69 days.

It may be well to know whether or not we are tying up too much of our money in frozen assets, i. e., machinery, buildings and equipment on which we can never realize more than 20 cents on the dollar if we have to liquidate. We also might decrease our working capital by this method, which might tax us to carry on our business. We will see what percentage the Standard Block Corporation has in fixed assets. As shown on Exhibit J. 2, it has $39,000.00; while the capital is $50,000.00. The percentage of the fixed assets to the net worth would be as follows:

$$\frac{\text{Fixed Assets}}{\text{Net Worth}} = \frac{\$39{,}000.00}{\$50{,}000.00} = 78\ \text{per cent}$$

The ratio of the fixed assets to the net worth in this case is 78 per cent, which no doubt is too high. If the corporation makes money, the expenditure is justified. On the other hand, if the corporation has a few bad years, it would find itself in a hole.

Do our creditors own our business? If not, how much do they own? In our hypothetical business, the balance sheet shows that our net worth is $50,000.00 and the debt is $11,000.00. The percentage of the total debt to the net worth would then be as follows:

$$\frac{\text{Total Debt}}{\text{Net Worth}} = \frac{\$11{,}000.00}{\$50{,}000.00} = 22\ \text{per cent}$$

the ratio of the total debt to net worth.

Our next step will be to make an analysis of the cost of manufacturing.

1. Is our production reasonably proportionate to sales

(Concluded on Page 35)

~ EDITORIAL ~

Standardization of Admixtures

THERE are few subjects among concretors that will give rise to as much difference of opinion as the subject of admixtures. Ever since portland cement was offered for sale in the United States the architect, engineer and contractor have been offered a variety of materials which were claimed to have qualities that would improve either the watertightness, workability, placing or hardening of the concrete.

Today there are any number of admixtures on the market—each claiming some one or several advantages when used in the mix along with the aggregates, cement and water. So many are the materials and so many are the claims made for them that the contractor or designer is often confused and bewildered unless he has established their value through personal experience.

Admixtures are being used in concrete for a surprisingly great volume of work. Contractors and engineers have found, through personal job experience, that many admixtures do fulfill the claims made for them. They consider the advantages they bring as being worth more than the additional cost of the concrete. Yet, the only method of judging their value is to try them out on the job or to accept the statements of the salesman.

It would be of tremendous value to concretors if it would be possible to find some method of officially classifying and approving admixtures. In a field such as this, it is not strange that there should be impostors, claiming advantages for their product that are not there. An official classification and stamp of approval by some disinterested technical body such as, for instance, the American Society for Testing Materials, would relieve the contractor or architect or engineer of the necessity of making his own tests or tryouts and would enable him to specify with assurance.

Admixture manufacturers who sell a product that actually meets the claims made for it would welcome such official classification and approval. Users of admixtures will welcome it for they prefer standardized materials purchased under official specifications.

Are there any insurmountable reasons why admixtures cannot be officially classified and covered by standard specifications?

Money for Construction

PROMINENT financial authorities whose predictions carry confidence have made the statement that the upset in the stock market is having a stabilizing influence and that builders and contractors may look forward to a large volume of construction, both in the large structure field and in residential building. They definitely indicate that the retarding influences that have operated to withhold money for construction are removed and that large sums will be available for construction purposes at very favorable rates of interest.

Few concretors have not felt the adverse effects of the crash in stock prices, but they may now look forward to a period in which construction of all kinds will be greatly stimulated. The year of 1930 will present an opportunity for aggressive contractors and products manufacturers that will enable them to capitalize fully on their sales efforts.

Better Concrete

IN the last analysis it is the man on the job who determines the quality of the concrete that goes into any structure. It is he who proportions the aggregates, adds the water, operates the mixer, takes the concrete to the forms, places it and cures it. And it is his performance in any or all of these operations that fixes the degree to which they have been properly carried out.

It is necessary that the laborer—the wheelbarrow man included—understand that upon him rests a certain degree of responsibility in securing the results aimed for. If he has been encouraged to know some of the fundamental simple requirements for making good concrete, he may be expected to take a more active interest in the quality of the work and to use his influence to secure good results.

We have had schools for engineers and for contractors in which the basic principles of concrete making were taught. Is it not just as desirable for the contractor to teach his force those simple underlying requirements which they can understand?

Looking Ahead

WHEN you receive this issue, 1929 will rapidly be drawing to a close. Another year of accomplishment will have passed and again it will be in order to sit back and permit the year's experience to help you formulate the plans for 1930.

Big things are ahead for the construction industry in 1930. In all branches of construction—homes, public works of all kinds, railroads, industrial buildings—there are potential jobs awaiting the builder.

Now is the time to prepare the way for next year's work. Winter selling of spring business gets you off to a flying start. Determine now to sell harder this winter than you have ever done before and then you may hope to see 1930 one of the most profitable years in your career.

From the Products Associations' Bulletins

Wisconsin Concrete Products Association

JACK FRANKLIN, Secretary-Treasurer

Weekly Letter No. 21 makes announcement of the 1930 Wisconsin convention plans, to be held on the 29th and 30th of January at Milwaukee.

"The program itself is made up almost completely of new names and new faces. Several speakers have been selected who are nationally known for the particular work that they are doing. It is expected that this will be the strongest program by far that the Wisconsin Association has ever held," according to the Letter.

Letter No. 22 covers "Expansion and Contraction of Concrete Masonry Walls."

To quote:

"To determine what effect age and moisture content may have on expansion and contraction in concrete masonry walls, the Cement Products Bureau of the Portland Cement Association has had five concrete masonry walls under observation. These were erected with units of different ages and varying moisture content.

"Panel No. 1 erected with 9-day old moist cured units containing 20 per cent of moisture. Total contraction when period of stability was reached (150 day) was 9/10 inch per hundred feet of wall.

"Panel No. 2 was erected with 36-day old moist cured units containing 19 per cent moisture. Shrinkage same as No. 1.

"Panel No. 3 was made of air-cured units 36-days old containing 1.6 per cent moisture. Maximum shrinkage for period of one year was 3/10 inch per 100 feet of wall.

"Panel No. 4 was constructed with 36-day old units which had been oven dried for two days and then had 6 per cent of moisture added by sprinkling immediately before erection. Maximum variation over long period was 1/10 inch per 100 feet of wall.

"Panel No. 5 which was erected with units in an oven-dry condition had a maximum expansion of about 3/10 of an inch in 100 feet during the first 50 days due to absorption of moisture from the mortar and the air. By the end of one year the wall contracted to within 1/10 of an inch per 100 feet of its original length.

"It is our recommendation that after moisture had been used to develop the full strength of the concrete, the units be piled so that the air can circulate freely through them, preferably under cover. Precautions should also be taken to keep the units dry after they are delivered on the job."

Iowa Concrete Products Association

R. L. GAVIN, Secretary-Treasurer

"NOBODY expects much of a bear in winter. It's the nature of the beast to retire into the privacy of his den, there to dream of honey and berries—joys he expects to materialize when winter's over.

"Yet America's second industry, the building industry, adopted the winter habits of the bear a long time ago and, simply because habits are hard to shake off, today takes for granted that the winter months are fit only for idleness and for dreams of business 'when the construction season opens.'

"As a matter of fact, the 'construction season' is twelve months long. Every contractor knows that he can do good work during the winter providing he observes a few simple precautions. These precautions in concrete work are so easily taken and at such small expense that the benefits of earlier, more timely completion of jobs more than overbalance them," it continues.

"From every standpoint, winter building to eliminate the old winter slump is advantageous. If American builders are not allowed the habit of hibernation to become firmly fixed, the three months of December, January and February would find a quarter of the year's construction under way. As it is, the proportion is very much less."

Quoting a merchandising publication, under the heading "Business—Then Friendship," the Iowa bulletin says, "Of course, nobody wants to be a crab, easily convertible into vinegar under the first sour apple tree.

"But on the other hand, as the glove salesman remarked, 'Sunshine can be concentrated to such an extent that it is uncomfortable.'

"In other words, probably it's the best policy to strive for the happy medium, avoiding undue strain on personal relationships.

"Merchants tell us that many salesmen, after they become well acquainted in the territory, are inclined to trade on their friendship in a constantly increasing ratio.

"Instead of putting the interest of the business first, or going out of their way to make themselves useful, if the weather is hot or the road is bad, they take a chance on calling the merchant and getting the order by telephone.

"Even a tyro can figure out that a merchant with jumping vertebrae induced by an overdraft on his good nature is a living prospect for the first competing salesman who happens along.

"When a man is placing the interests of his business ahead of wife, children and bridge, he cannot be expected to make an exception for the representative of a house he is buying from, regarding roads, weather or golf.

"He wants service and he is going to get it. Service not only in the merchandise, delivery and other elements incidental to every transaction, but service in his personal relations with the salesman, probably the only man he ever sees from the firm, the man who is the firm to him. Service of the type implied sustains the most permanent and profitable friendship."

All Products Men Invited

A warm welcome is promised manufacturers of its own state and others who attend its coming convention by the Wisconsin Concrete Products Association.

All are invited to attend the meeting at Milwaukee, Wisconsin, January 29th and 30th.

In Defense of Integral Waterproofing

Some Thoughts on Water Repellent Admixtures—Types of Admixtures—Need for Official Classification—Watertight vs. Waterproof—Admixture Specifications—Some Tests

By R. E. WITHROW

It is not good salesmanship to open with a negative thought, but facts are facts and must be so considered. In the past unfavorable mention of the use of integral waterproofing in concrete has appeared in our trade journals from time to time; rarely has favorable mention been made.

While reference will be made here to various types of admixtures, it is the intent to dwell upon the merits of the water repellent type of integral waterproofing, with suggested classifications and tests, including a brief of what such a material should be and what can be expected from its use.

Ever since the first portland cement was manufactured and offered for sale there have been those outside the industry who have endeavored to furnish some type of material which would make better concrete and cement work. This has gone on down through the years with many of the producers falling by the wayside and others taking their places. Prior to the introduction of American made portland cement and during the early days of the American industry ordinary clay, kaolin, lime and pulverized silica were offered. Today, there are myriads of admixtures offered, with apparently no end to the number that may yet be brought forth from the waste piles of our varied industries.

Many Types Available

Those of the building industry who control the use of the materials used in the construction work, viz.: architects, engineers, contractors and builders, are overwhelmed and bewildered and hardly know which way to turn. The advent of the water-cement ratio of pouring concrete with its own particular vernacular of "plasticity, segregation, fineness modulus, cement paste, slump test, water control, etc.," has brought forth many "densifiers, water retainers, plasticising materials, anti-segregators" to add to the already confused mind of the specification writer. It is undoubtedly true that a certain type of admixture is beneficial when used for the actual purpose for which it is intended, but it is also true that it is of no benefit when used for a purpose for which it is not intended and cannot fulfill.

Practically every admixture offered for sale to the building industry is also classified as an integral waterproofing material—a claim which is not only exaggerated but erroneous. Some admixtures may assist in making concrete watertight, but with the exception of actual water-repellents, the very nature of many of these admixtures precludes the claim for waterproofness.

Admixture Classification

It is recommended that all admixtures for concrete be classified under their own general types, viz.: 1st. Integral waterproofings, which shall include only such materials as are water-repellents; 2nd, plasticising or lubricating materials, or those used to prevent segregation, such as lime, diatomaceous earth, or silica, volcanic ash or clays; and 3rd, the calcium chloride combinations, which should be used as accelerators and to hasten the set of concrete or floor topping, frequently termed "anti-freeze solution." The heading of "fillers" means nothing, but might possibly be used to include materials which would be actually detrimental to concrete, although doubtless there are good materials offered to the trade and erroneously termed "fillers." Any finely divided inert material used as an admixture for concrete is a filler, as it probably tends to make the mass more compact. "Densifiers" may be regarded the same as "fillers." Tests made by the Portland Cement Association exploded the theory that any perceptible decrease in porosity of good concrete was obtained from any such materials.

Fortunate, indeed, would be the building industry in its entirety if through some nationally recognized association, say the A. S. T. M., an accurate and definite classification could be made of the different types of admixtures, eliminating the "cure-alls" and "cement doctors," putting each in the exact classification where it belongs. If it is an integral waterproofing of the water repellent type, classify it as such so the architect and engineer will know what results to expect. If it is an accelerator, or a lubricating material, or a "densifier" or what-not, put it in its own class and clear up the present chaotic condition of the industry as it exists today.

After these twenty odd years of using integral waterproofing it is, presumably, a natural assumption that the building industry as a whole actually and clearly understands what is meant by "integral waterproofing," its action, effect, composition, or results obtained. Unfortunately, this general knowledge is not an actual fact, regardless of the thousands and thousands of dollars expended in first class advertising, the hundreds of thousands of personal letters and direct mail pieces to architects, engineers and contractors, to say nothing of the many personal interviews and discussions on the subject.

Waterproof Vs. Watertight

To many in position to control the materials used in construction, no consideration is given to the difference between "waterproof" concrete and "watertight" concrete. A little thought on this subject will cause many to realize the basic cause of unsatisfactory results where real waterproofed concrete should have been secured. A little more concentrated thought will enable one to properly classify the many types of materials now being offered the market under the general heading of "Integral Waterproofing" and put them where they belong. They cannot be an efficient integral waterproofing, an accelerator, a filler or densifier, a lubricator, a hardener and a general cure-all at the same time.

The two accompanying photographs are different views of a concrete water reservoir, built about seven years ago, in the Middle West, which is twenty feet deep with ten feet of the wall above the ground. The engineer in charge of construction specified a well known "lubricating and densifying" material as an integral waterproofing.

These photographs clearly show leaks in the walls and the disintegration of the concrete caused by the freezing of the water absorbed by the concrete.

The building industry, as a whole, and the manufacturers of these different materials would be greatly benefited, financially and otherwise, if such classifications of admixtures of concrete were actually made and the materials purchased and used on the basis of the results which they could actually produce.

The suggestion for classifying different admixtures for concrete is offered not only to the architect, contractor and engineer, but to the many technical associations, the testing laboratories, engineering societies and technical colleges, too, are concerned and should handle the subject in an entirely unbiased manner instead of as at present.

Concrete which will be exposed to the elements, to water, to moisture or to dampness should be waterproofed by the use of a water-repellent type of integral waterproofing, whether a calcium stearate powder, an ammonium stearate paste or a waterproofed portland cement. Such concrete will be permanently waterproofed if the correct amount of water-repellent material is used in the mix.

Watertight concrete when subjected to the same water conditions is not as good as waterproof concrete, and while it is justly claimed that watertight concrete can be made in the field without the use of an admixture, including more cement, the day is passing for the claim that waterproof concrete can be obtained on the job in the same manner. Watertight concrete will absorb water and moisture, as capillary attraction will pull this moisture into the concrete and ultimately cause unsatisfactory results. Properly and adequately waterproofed concrete will not absorb moisture or water deeper than the surface pores, as the capillary attraction is overcome.

If concrete was not of a capillarity nature, or if it were possible to make concrete so absolutely dense throughout that water or moisture could not penetrate beyond the depth of the surface pores, the question of waterproofing concrete would never have arisen. But, such perfect concrete cannot be made and it is necessary to give the subject very serious consideration from more than one standpoint. The integral waterproofing must furnish the concrete sufficient water repellency to overcome the capillary attraction; it must be of such a nature that it will retain its water repellency during the life of the concrete. It must not interfere with the setting of the concrete, nor affect the color; it must not prevent the concrete from gaining its ultimate strength; and, in most instances, it must be moderate in cost in comparison with other materials of merit which are used for waterproofing concrete.

Different views of the seven-year old concrete reservoir. The engineer in charge of construction specified a "lubricating and densifying" material as an integral waterproofing

Good Concrete Always Necessary

Let it be clearly understood that the use of an integral waterproofing or an admixture should be no excuse for the pouring of any but the best type of concrete. Lean, porous, or honeycombed concrete, or a generally poor type of concrete cannot be successfully waterproofed at the time of pouring by even the best type of integral waterproofing, and no such idea should be created nor such an impression given that it can be.

The proper waterproofing of concrete, naturally, means that the concrete will not absorb water nor allow water to gradually percolate through the concrete, whether from the inside out, or from the outside in, regardless of the type of structure. A water repellent integral waterproofing not only does this, but the waterproofing protects the concrete itself from the action of water and any impurities or acids which it may carry.

Water waste, due to water or moisture passing through concrete walls and floors runs into millions of dollars loss every year. Goods stored in basements are in many instances ruined; in fact, many basements are useless to the owners or tenants, and represent a loss in investment, plus the loss of the ruined stock and the inconvenience.

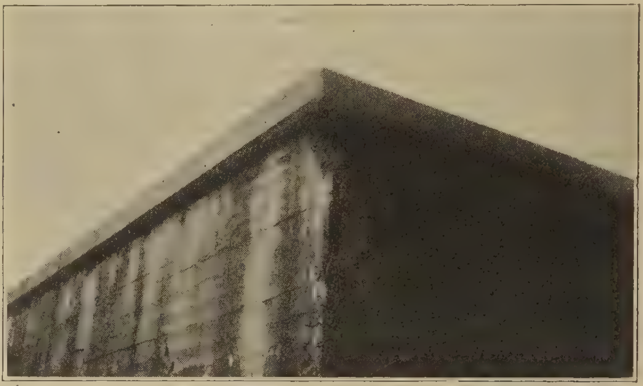
The saving of the disintegration of the concrete due to the action of frost or freezing of absorbed moisture; the protection of the reinforcing rods from absorbed moisture, with the resultant expense of repairs; or the prevention of the staining or discoloration of the concrete, more than repays for the use of the waterproofing.

Any architect, engineer, contractor or builder is now in position to assure himself that the proper grade of integral waterproofing is being used in his work by requiring a guarantee from the manufacturer that the waterproofing will comply with the U. S. Government Master Specifications for Integral Waterproofing, which clearly outlines the requirements for the water-repellent type of integral waterproofings or waterproofed portland cement.

In the past there have been no definite specifications for a systematized method for taking tests of the value of integral waterproofing. Such tests should be universally recognized as dependable by architects and engineers.

Admixture Tests

A great many years ago, the Bureau of Standards attempted to make a series of tests of all materials which were being sold as integral waterproofings. The results of these tests were published in 1911. The water-repellent materials tested did show they were of value to concrete



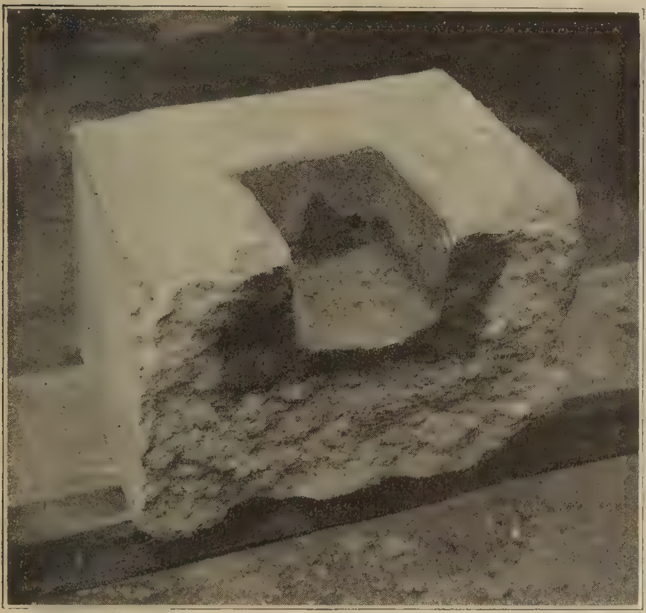
and mortar, but unfortunately those making the tests overlooked the value of classifying the different materials under their proper types or headings and their conclusions included not only the materials which proved to be of value but also the majority of the materials tested which proved of no value, and consequently, the conclusions, as a whole, stated that integral waterproofings were not necessary.

A careful perusal of the different tests set forth in Technologic Paper No. 3 clearly indicates that the water-repellent materials perform the functions for which they are manufactured. On page 46 of this report is a schedule of the analysis of the water-repellent integral waterproofings which the bureau tested. A checking of these materials will show they were effective in mortars of very lean proportions, as well as in the richer proportions.

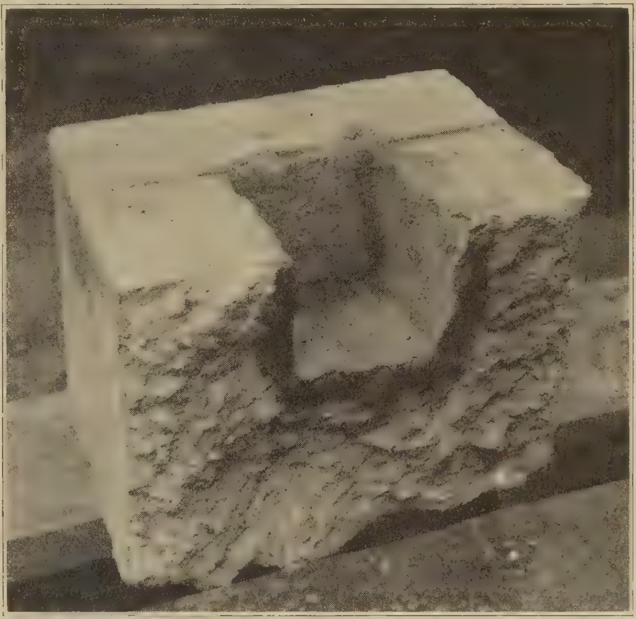
This old series of tests by the Bureau of Standards has been effective in retarding the use of integral waterproofing, although the growth of the industry has been increasing annually and today represents a considerable tonnage.

The water-repellent integral waterproofing industry has been lax in that no concentrated effort has been made to secure the proper classifications of admixtures and specific methods of testing water-repellent materials for their value.

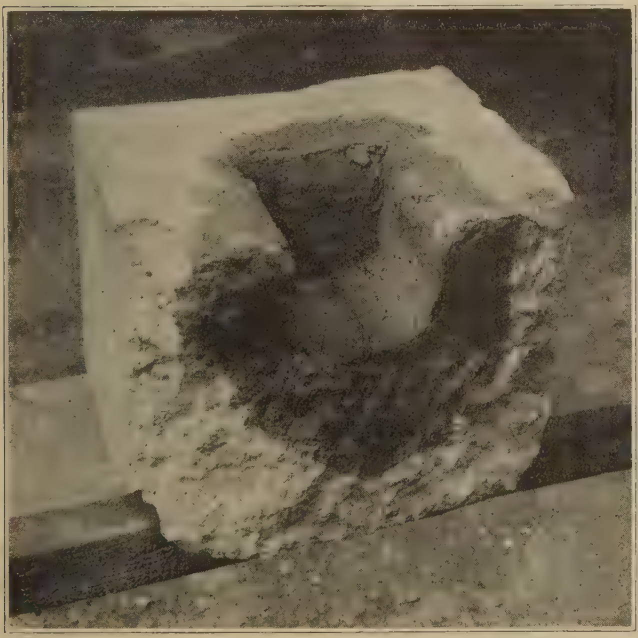
The gradual increase in the use of such integral waterproofing and the interest aroused by the efforts of the individual manufacturers is undoubtedly the cause of the Bureau of Standards making a further investigation along the lines of test requirements by taking the matter into its own hands and through its own initiative corresponding with the different manufacturers, requesting their suggestions for tests, resulting in the Master Specifications for Integral Waterproofing.



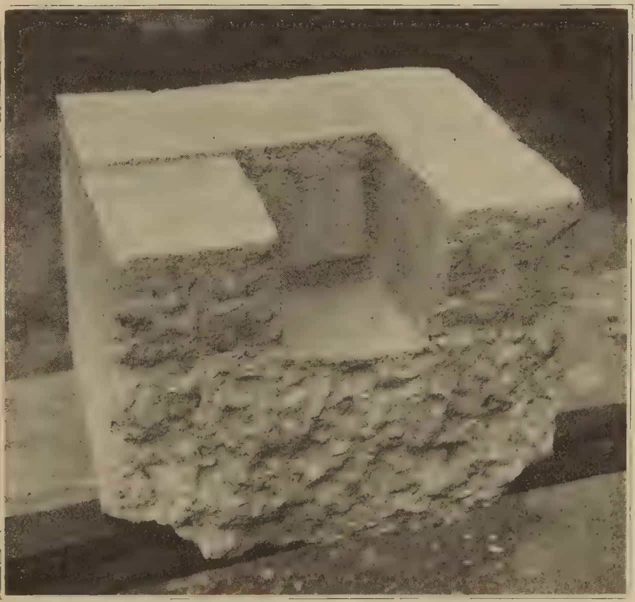
Specimen A. Plain concrete, in which no admixture has been used



Specimen C. Plain concrete surface treated with chemical floor hardener



Specimen B. Plain concrete in which a lubricating material was used



Specimen D. Waterproof concrete—a water-repellent type of integral waterproofing used. The surface of block "D" was slightly stained when the potassium permanganate solution was poured off after the seven-day test

Different investigators, technical schools and testing laboratories have at various times made tests of admixtures and integral waterproofings, some of which were made along practical lines and some along theoretical lines, but all in laboratories.

Not long ago, in a nationally known magazine, a series of tests were published showing tests of many different admixtures. A casual reading of these tests would indicate that all admixtures were of little, if any, value to the concrete, but the investigators did not carry their mathematical calculations out sufficiently to show the percentages of absorption. A further checking of this particular series of tests brought to light the information that six of the integral waterproofings and admixtures had less absorption than the specimens of 1:2:3 concrete; that sixteen of the admixtures had a lower percentage of absorption than plain 1:2:4 concrete and that the water-repellent type of integral waterproofing showed the least absorption of any of the admixtures.

A Recent Test

A convincing test which demonstrated the value of the water-repellent type of integral waterproofing is shown in the accompanying four photographs. These tests were made by a private testing laboratory of a nationally known engineering company during the course of an extensive research of portland cement.

After these cubes were made they were kept in the forms for two days and cured in air for five days and when seven days old the core was filled to within ½ in. of the top with a potassium permanganate solution, which was kept at a constant level for seven days, by daily adding enough solution to replace that absorbed by the concrete. Evaporation was prevented by keeping the opening tightly covered with glass plates.

The photographs indicate the penetration into the concrete. All blocks were of 1:2:3 concrete with admixtures as noted.

A comprehensive series of tests were made by Dr. L. A. Palmer, research associate, Bureau of Standards, for the American Face Brick Association, with a view of determining the value of water-repellents in brick mortar for the prevention of efflorescence. In Dr. Palmer's report, which has been widely distributed, by both the Bureau of Standards and the Brick Association, he states: "It is further evident that in order for this condition to be realized the water-repellent substances must be used in all the mortars in the walls, in the backing as well as in mortars used with the face brick."

His report is known as Technologic Paper of the Bureau of Standards, No. 370, and should be carefully read by anyone connected with the building industry who is interested in masonry work.

Tests made in laboratories will indicate, comparatively, the value of integral waterproofing and other admixtures. It must be remembered that field conditions cannot duplicate the nearly perfect methods of a laboratory.

Tests to be of actual value to the building industry should be made in the field, with the complications of field conditions, the concrete being mixed in the same machine used for pouring foundations, floors or other concrete work. Specimens can be taken from the carts or wheelbarrows from different batches, poured into molds, instead of forms, puddled or spaded similarly to the concrete in the forms and treated the same as the actual concrete in the walls or floors. If the forms are stripped from the walls within 24 hours, let the mold be taken from the specimen within 24 hours. Cure the specimen the same as the other concrete is cured. Do not favor or humor the test specimens in any way, except with a view of getting comparative results for different types of curing. The Bureau of Standards, a large reputable testing laboratory, or one of the nationally recognized technical colleges, would have sufficient equipment and personnel to conduct such tests, and the results obtained would tell the building industry as a whole what real value or merit the integral waterproofing or admixture tested has in concrete. It does not seem to be entirely reasonable to make the waterproofed disks for pressure tests only 2 in. thick. Water pressure, up to a 20 ft. head, or greater, may gradually show on the underside of the disk. In actual construction, such concrete would be of the required thickness, instead of 2 in. Ordinarily, when concrete is used in constructing a building, the idea of permanence is uppermost in the owner's mind. The foundation walls are sufficiently heavy and thick to resist all pressure from the outside. The waterproofed test specimens should be given just as much of an opportunity to prove their value as is the concrete poured into the walls.

No value could be attached to such tests if they were made of concrete which is too lean, too porous, too weak, for practical purposes, and the specimens should be just merchantable concrete, approximating the old 1:2:4 mix or richer. The fallacy of such mixes of concrete being absolutely waterproof without the addition of a water-repellent waterproofing has been proven by the many building operations throughout the country where such type of concrete was not waterproof and had to be made so at an additional expense to the owner.

That the water-repellent type of integral waterproofing will stand the test of time in actual construction work is proven by the many building operations in which this type of material has been used, not only in buildings but in tanks, vats, pits, tunnels, swimming pools and underground work subjected to water and moisture, from mere earth dampness to heavy hydrostatic pressure. Architects and engineers repeatedly insist upon the use of integral waterproofing, as do many contractors. They know that the water-repellent type of integral waterproofing not only makes the concrete waterproof, but enables them to secure all of the benefits derived from waterproofed concrete.

Concrete Tanks Display Acquarium Exhibits

In Golden Gate Park, San Francisco, Calif., extensive use has been made of concrete for permanent exhibitions of live fish, etc.

The building is constructed of concrete and for the purpose of accommodating the great variety of fishes, reptiles, etc., there are over a hundred concrete display tanks.

Coming Conventions

January 11th to 18th—American Road Builders Association twenty-seventh annual convention and road show. Auditorium, Atlantic City, New Jersey.

January 29th and 30th—Wisconsin Concrete Products Association annual meeting, Milwaukee.

February 11th to 13th—American Concrete Institute annual convention. Hotel Roosevelt, New Orleans, Louisiana.

In this monolithic concrete surface the wall has had the "fins" removed and the color brought out by a cement wash

Monolithic Concrete Surfaces

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Beauty of Solid Concrete Need Not Be Hidden from View — Facts About Forms, Mixing, Placing, Removal of Forms, Repair Work, Decorative Treatments of Exposed Surfaces

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ALTHOUGH concrete was, at first, employed for purely utilitarian purposes, a new era has begun to dawn during the last ten years for monolithic concrete and even now it can be said that this material is firmly established as a very important member in the family of decorative building materials.

The reason why concrete was, at first, used almost exclusively for structural purposes and not for creating decorative effects was because it became recognized, almost at once, as a material that was very suitable for warehouses and manufacturing buildings. It was strong, and unlike other materials it needed no protective coverings. It could be used for foundations, footings, columns, girders, beams, floors and curtain walls. In short, concrete could accomplish something which had never before been attained; it could form a structure which was molded into a monolithic whole. The low cost of this superior fireproof type of construction, combined with many other advantages resulting from its use, appealed so strongly to manufacturers that its success and widespread adoption for industrial structures was soon apparent.

In many structures little attempt was made to produce uniform, attractive surfaces. Unsightly pockets of coarse aggregate, held together with a surprisingly small amount of cement paste, were too often seen on concrete surfaces exposed to view. Poor formwork often produced scars which could hardly lend to the attractiveness, if any, of the surface. "Fins," resulting from cracks in the formwork, were seldom removed in the proper manner. Ornamentation, when such was attempted at all, was usually an attempt to imitate the older forms of design such as those executed in brick, stone or granite. The results produced could certainly not be called beautiful.

A New Architecture

But concrete was not destined to be always treated in this crude fashion. Nor was it destined to be used only for industrial buildings. In fact, concrete is no longer considered fit only for dams, viaducts and warehouses. Architects and builders are now beginning to realize the possibilities of concrete as a valuable decorative building material. It can be molded, modeled and carved. It can be used to develop an infinite variety of colors and textures by the proper selection of aggregates and surface treatments. Likewise, it can be painted and stained.

Although it is almost as impossible to issue exact specifications for the craftsman's work in decorative concrete as it is to give an artist exact specifications about the painting of a picture, the rules for producing concrete surfaces which will be exposed to view should cover forms, mixing, placing and finishing.

Forms

Forms which will produce concrete surfaces that will later be exposed to view must be smooth and watertight. If wooden forms are used they should be constructed of planed tongue-and-groove material, evenly matched and tightly placed. They should be constructed in sections of such dimensions and shapes as will make their removal easy without undue hammering and without prying against the face. If small openings are discovered after the forms have been constructed, they may be pointed flush with stiff clay or plaster of paris in order to prevent leakage or the formation of fins.

Wherever possible, skilled carpenters should be employed for the construction of forms for concrete that will be exposed to view. Those who are accustomed to working only with an ax, a hammer and a saw will not qualify for the job. Carpenters who have been working on interior wood finishings can be relied upon to see that forms are plumb and aligned properly. Likewise, they will often devise methods of using screws in place of the customary wire nails. The use of screws will often help in the removal of forms and will make possible the minimum amount of prying and subsequent damaging of the concrete surface. Not a great deal of skill and experience is required to make smooth, first-class form panels but considerable experience and skill is required to set these panels in place, plumb and properly aligned, and fasten them so there will be no movement under the weight of the concrete.

Any movement between adjacent form panels will produce a ledge of some kind that is plainly visible in the concrete surface. Despite first class workmanship and care in placing forms, such ledges sometimes occur. In this case, it is well to design the forms in panels of such sizes and shapes as will result in ledges or lines conforming to the architectural design of the building. For example, the ledges or lines can often be used to create the impression that a concrete structure is composed of large units, precast or hewn out of solid rock and set in place in the building.

Mixing

Mixing is an important item to consider in producing attractive monolithic concrete surfaces. It is essential that the same brand of portland cement and the same kinds and sizes of aggregates be used for every batch of concrete intended for a surface which must be uniform in color and even in texture. The use of different brands of cement is very likely to result in concrete of different colors even if the aggregates are the same in all mixes. The difference in colors obtained by using various kinds of cement is due, primarily, to the different sources and kinds of raw materials used by the various manufacturers of cement. Some manufacturers have mills located in more that one part of the country, so, as an added precaution for obtaining uniform color in monolithic concrete it might be well to use not only the same brand but also to use cement shipped from one mill.

Concrete that is to have an attractive surface must be mixed uniformly. The only way to have a uniform mixture is to mix the materials thoroughly. Uniformity in mixing can be most easily obtained by the use of machine mixing, accurately timed. The product resulting from hand mixing will probably be more variable. Uniform distribution of the aggregate is necessary to prevent segregation (separating of the aggregate from the cement paste) and unsightly voids in the surface.

Controlling the amount of mixing water used is an important factor in proper mixing. It is now definitely established that the amount of mixing water used affects directly the *strength*, the *porosity* and the *appearance* of the finished product.

The strength of concrete at a given age will be determined by the amount of water used with each volume of cement, regardless of what quantities of aggregates are used, so long as the mixture is plastic and workable and the aggregates are clean and made up of sound materials. This principle may be more readily understood if the cement paste is thought of as a glue binding the aggregate particles together. Increasing the water content dilutes the glue and reduces the strength.

Monolithic concrete surfaces which are to endure must be produced with concrete which is not unduly porous. And the porosity of concrete is influenced greatly by the amount of mixing water used. Too dry mixes do not work properly into place and result in air pockets or honeycombing which make a porous concrete. Likewise, honeycombing affords starting points for disintegration if the concrete is exposed to weathering. Over-wet or sloppy mixes produce a highly porous concrete and may also result in segregation and the formation of laitance (an accumulation of the finer materials of the cement and aggregate) both of which weaken the resistance of concrete exposed to weathering. Many contractors use approved types of admixtures to aid them in securing these results.

Placing

No matter what the consistency of the mix used, the concrete must be worked into place. This will help to insure a perfect surface free from voids and of uniform texture. If the finish is one in which the coarse aggregate must be exposed, by scrubbing, tooling, sand-blasting or acid treatment (surface treatments that are later described in this article), then the full surface of mortar must be worked against the form. The spading tool must be inserted in the concrete and the coarse aggregate must be pressed against the form in order to obtain uniform distribution at the face and a uniform texture after the aggregate is exposed.

When a surface of mortar is to be the basis of the finish the coarse aggregate must be worked back from the form with a suitable tool, so as to bring a full surface of mortar against the form, care being taken to prevent the formation of voids and air pockets.

Removal of Forms—Repair Work

Face forms should be removed as soon as practicable, in order to permit effective repair work of void spaces or broken corners before the concrete has dried or hardened too much. While the concrete is still in this "green" state care must be taken to prevent roughening of surfaces or injuring of corners or edges. Again, careful construction of forms to permit easy removal will help to prevent such damage.

As soon as the face forms have been removed, any fins or other projections should be removed. All exposed wires, nails or bolts must be removed or cut off at least one inch from the surface, so as to provide sufficient key for the pointing mortar, and to insure against water reaching any pieces of metal and causing rust spots. Voids or damaged places should be immediately saturated with water and filled with a mixture of the same composition as that used in the surfacing and brought even with the surface by means of a wooden spatula or float. A steel trowel should not be used to finish the surface. After the forms are removed the surface of the concrete should be immediately wetted and kept wet for at least three days.

Decorative Treatments

Most of the foregoing information has dealt with the essential points to be considered in producing a surface of reasonable regularity and free from any but minor defects. These are what might be called the minimum requirements that must be observed in the construction of any surface that is to be exposed to view.

In addition and especially if the surfaces are not in harmony with the architectural design desired, a great deal can be done to produce more attractive surfaces by treatments of various kinds.

Granolithic Surfaces

If a granolithic surface is desired, a mix consisting of approximately 1 part portland cement, 1½ parts of fine aggregate and 2½ parts of coarse aggregate made up of pebbles, crushed granite, or other stone which may be desirable and suitable will form a satisfactory facing concrete. The granolithic surface is made by placing about 1 in. of facing material against the face form in advance of the ordinary concrete. Care must be taken that the facing concrete is placed in a manner that will insure its bonding with the ordinary concrete. If metal or wooden molds are used as auxiliary forms to retain the facing concrete against the regular forms while placing the ordinary concrete, care must be taken that the mold is removed before initial setting occurs. The molds should be jarred frequently and raised at short intervals to prevent formation of seams and air spaces between the surface concrete and the ordinary concrete, and to insure a satisfactory surface.

Rubbing monolithic concrete with carborundum stone to develop smooth, attractive surface finish

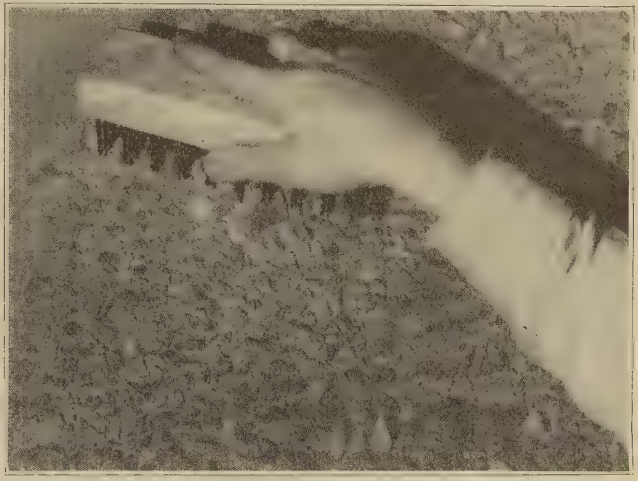
Rubbed Finish

What is known as "rubbed surface" is probably the least expensive of durable surface treatments. The forms are removed as soon as possible. The surface is then wet thoroughly and rubbed with Number 20 carborundum stones while the concrete is still "green." The concrete paste that works up on the surface should be removed by brushing and washing. Small voids in the concrete should be filled with a mortar composed of portland cement and the same kind of sand as that used in the facing concrete. A mortar composed of one part cement and two parts sand is often used. This mortar should be worked into the face with carborundum stones so that no appreciable thickness of coating remains. A coating of appreciable thickness will probably peel off and crack if exposed to extremes of temperature.

Several months after the first rubbing and when the concrete has attained a considerable degree of hardness, the concrete surfaces exposed to view are rubbed down again. This time Number 24 carborundum stones and water are used. Again a paste will be worked up which should be removed with a clean, wet brush or by rubbing with a piece of clean bagging. A surface produced by the treatment just described will resemble limestone in color and texture and will prove very durable. It must be realized, however, that such treatment does not usually remove all board marks.

Scrubbed Finish

Another form of surface treatment is known as "scrubbed finish" or "brush finish." The forms must be removed while the concrete is still quite green. The surface is then scrubbed with wire brushes, water being used freely. The scrubbing is continued until the surface film of mortar is removed and the aggregate is uniformly exposed. The surface is then rinsed with water. If parts of the surface have become too hard to scrub in equal relief, diluted hydrochloric acid (1 part acid to 4 parts water) may be used to facilitate scrubbing. All acid must be removed with clean water after the scrubbing has been



Scrubbing monolithic concrete with wire brush to expose aggregate for "scrubbed finish"

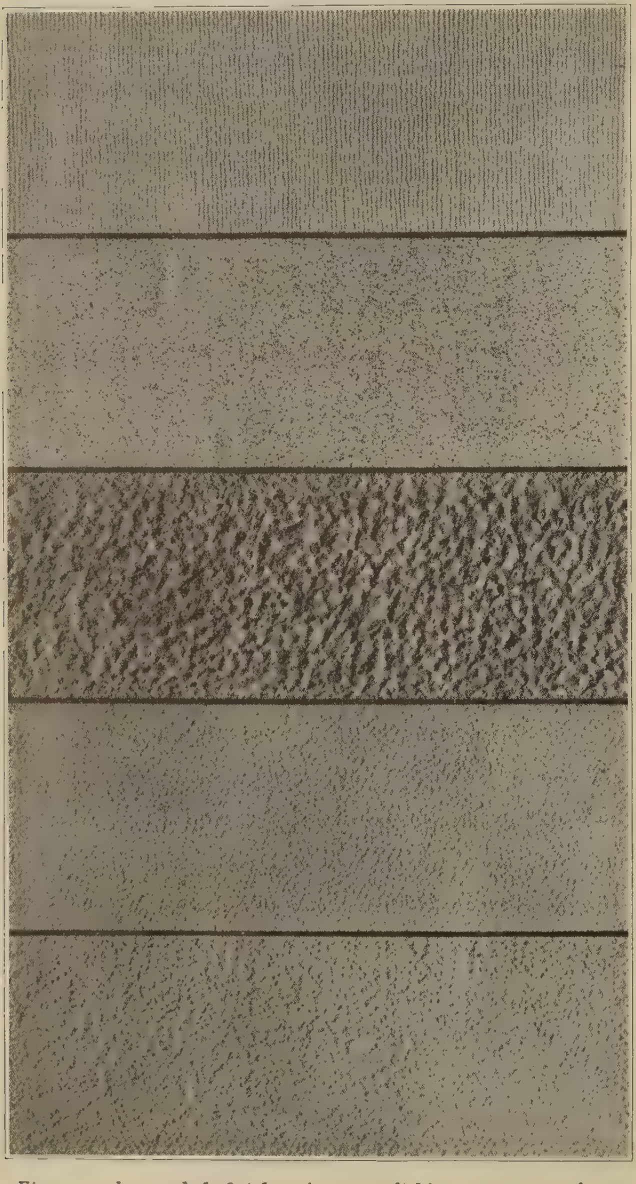
Washing monolithic wall after acid treatment done to prevent further chemical action between the acid and the cement in the concrete.

Good judgment, gained by experience, is required as to the proper time to begin scrubbing. If the scrubbing is begun too soon, unsightly voids may be made by scrubbing out pieces of large aggregate. If the scrubbing is not started soon enough, the surface will be so hard that the brush will not be effective enough to remove the surface mortar.

It is almost impossible to obtain sharp corners in scrubbed work and for this reason fillets of rounded moldings should be placed in the forms so as to leave no sharp corners in concrete which is to be scrubbed.

Sand-Blast Finish

Another method used to expose the aggregate is sandblasting the surface with hard sand until the desired degree of uniform relief is obtained. A concrete surface thus treated must have obtained, at least, an intermediate degree of hardness. The equipment necessary for this treatment is large and, of course, cannot be used on small jobs without a comparatively high cost for each unit of area treated.



Five popular tooled finishes for monolithic concrete surfaces

Tooled and Bush Hammered Finishes

Probably the most effective but, at the same time, the most costly method of exposing the aggregate is to tool or brush hammer the surface of the concrete. The "scrubbed finish" method which has already been described exposes the aggregate at less cost, but the surface resulting from tooling or bush hammering will be more pleasing because this method not only exposes the aggregate but cuts it as well. The cut aggregate gives a sparkle to the surface and a charm to the texture which is lacking in scrubbed surfaces.

The concrete must, of course, be thoroughly set and hard before tooling or bush hammering can be attempted. The tooled surface is obtained by striking the surface a sharp blow with a bull point. This may be operated either mechanically by an air or electric hammer or by hitting with a hand hammer. The texture obtained by tooling is used to best advantage on large work where it will not be subjected to close scrutiny. It is seen to best advantage from a distance of several yards.

"Bush hammered" or "dressed" surfaces, on the other hand, are admirably fitted for surfaces that will be seen at short range. They are, therefore, often used for ornamental entrances and similar decorative work. Bush hammering and tooling present difficulties at exposed corners because it is almost impossible, at such places, to prevent chipping out of pieces of concrete and thereby leaving ragged and unsightly corners. Two methods of dealing with this difficulty can be used. The surfaces at the corners can be given a "rubbed finish" and the hammering stopped at a sufficient distance from the corners to leave a smooth marginal draft line of a width that will be in scale with the panel that is being bush hammered. This consideration often leads to laying out the panels in such sizes as will be best fitted for treatment by hammering.

Another method is to eliminate sharp corners completely and to round off the edges by hammering. This, however, is seldom suited to architectural designs on account of the comparatively large amount of material it is necessary to remove in order to obtain a uniformly rounded corner.

Colored Aggregate Finish

Very pleasing and unusual textures can be made in monolithic concrete surface by careful selection of colored aggregates. Such aggregates are generally more expensive than the usual coarse aggregates purchased for ordinary concrete and mainly for this reason they are often used only in a facing. Such a facing is sometimes as thin as 1 in., but should preferably be thicker. The usual method of placing is similar to the one described for placing concrete granolithic surfaces.

The method is not usually practicable in columns and other structural members where the reinforcing steel obstructs the handling of the dams (auxiliary forms) which are used to keep the different classes of concrete in the places assigned to them. But in spandrel beams, walls and also in unreinforced members it is quite satisfactory to use colored aggregates.

The colored or special aggregate is exposed by giving the surface a "scrubbed finish" or a "bush hammered finish."

Colored Pigment Finish

Many mineral pigments may be mixed dry with the cement and fine aggregate which are to be used for a facing material. The mix may be placed in the same manner as the colored aggregate concrete, held in place by dams or auxiliary forms. Care must be taken to choose pigments that will resist weathering and that will not cause injurious chemical reactions to take place. Definite information on the use of mineral pigments was given in the article, "Concrete Floor Finishes," published in the October issue. These recommendations should be followed in making all colored concrete work.

Monolithic concrete surface processed by using colored aggregate, acid washing and brushing

Sand Floated Finish or Cement Wash

The surface is first cleaned thoroughly and voids are repaired in the manner previously outlined under "Repair Work." The surface is then wet thoroughly and a cement wash or mortar is rubbed into the surface with a wood float operated in a uniform circular motion. Practically any color, ranging from white or cream to the greenish gray color of cement, can be applied by varying the proportions of white cement with dark cement, and light or dark sand. A proportion of 1 part of white cement to 1 part of finely screened yellow bank sand, with 5 per cent of hydrated lime (by volume of cement) will give a shade just off white. This is probably the most serviceable color, as it does not show the dust streaks so quickly as white, and is still light enough not to show stains.

After mixing together the cement, sand and lime, in the proper proportion, the mixture is added slowly to water and stirred vigorously. The consistency of the mortar obtained should be about that of a very stiff oil paint. After this mortar or grout has been rubbed into the surface, a clean dry brush is used to brush the surface in the lengthwise direction of the board marks. All excess grout must be removed and only the thinnest coat, with which it is possible to cover the surface should be left in place. A thick coat must never be left because it would eventually craze and peel off.

A surface produced in very much the same manner as the one just described, except that the grout is rubbed in with a carborundum stone, will prove more enduring and of better appearance. The rubbing with a carborundum stone removes slight projections and insures a better bond by forcing the grout into the pores of the concrete. This finished surface could be called "semi-rubbed" and, of course, is more costly than a surface produced only with a wooden float and a brush.

Airport Conference Finds Highway Researches of Value

The Municipal Airport Conference, sponsored by the American Road Builders Association and the Aeronautical Chamber of Commerce of America, was held at Washington, D. C., October 24th and 25th. A comprehensive report of papers and discussions will be presented at the City Officials' program of the American Road Builders Association convention at Atlantic City, New Jersey, January 11th to 18th.

The conference established definitely that the airport is the point of contact between aviation and the highway builder and that the researches conducted on soils, drainage, construction, impact, and surfacing by highway engineers can be adapted with great value to the field of aeronautics.

Many of the salient facts that were brought out require compilation and a engineer-investigator is collecting all existent information for the municipal airports committee.

The Products Manufacturer Checks Up

(Continued from page 24)

requirements or is more stock being produced than we can hope to sell? We will want to know what per cent of the stock manufactured during the year remains in the inventory at the end of the year. To determine the ratio of manufactured volume to finished goods inventories, we take from the profit and loss sheet the cost of the goods manufactured (which is \$35,475.00) and the cost of the finished goods inventory on December 31 (which is \$4,775.00). It would then follow:

$$\frac{\text{Finished Goods Inventories}}{\text{Goods Manufactured}} = \frac{\$4,775.00}{\$35,475.00} = 13.46 \text{ pct.}$$

2. Do we carry adequate or excessive stock? The ratio of the finished goods on hand at the beginning of the period to the cost of the goods sold during the period gives the portion of the month's sales requirements provided by finished goods inventory. From Exhibit J. 1; the cost of the sales for the year was \$35,475.00 or an average per month of \$2,956.25. The inventory of finished goods January 1st was \$4,000.00. The percentage of each month's sales provided by inventory would then be 135.3 per cent; determined as follows:

$$\frac{\text{Inventory January 1}}{\text{Monthly Cost of Sales (avg.)}} = \frac{\$4,000.00}{\$2,956.25} = 135.3 \text{ pct.}$$

This figure shows that manufactured stock is being carried in this particular case to last about 40 days.

In conclusion, we will say that there are many other analyses of statements that could be made. We have illustrated those which we think are necessary for a better and more thorough understanding of a business. Ignorance of the facts of the financial condition of a business is inexcusable.

Business Goes Back to Work

American industry and trade, for the balance of the year and for the first quarter of 1930, will be retarded to some extent as the result of the upset in the stock market but after that may proceed normally. The upset in security prices is having a sobering influence but it is not anticipated that this will adversely affect the general credit situation. Further, it is believed that money rates will become low enough to permit greater activity in building, public works construction and industrial plant expansion and modernization. This is the opinion of the business paper editors of the country as developed by a survey jointly conducted by the National Conference of Business Paper Editors and the Associated Business Papers. In this each editor reported on conditions and prospects as he saw them in the industry or trade with which his paper is concerned.

In the main these editors agree that as the result of the crash in stock prices business executives will work harder at their jobs and pay less attention to the stock ticker. Further, they hold that the prospects for 1930 are excellent for the businesses ready to apply the needed additional sales-effort drive, but only those companies which will extend themselves to the utmost will come through the coming year with profits up to the level of the last few years.

No trade or industry has been distinctly crippled by the sudden decline in stock market prices and many of the editors feel strongly that the result will be lowering of money rates generally and its return from the call money market to localized employment. None of them reports drastic reductions in production employment and all hold that the industries producing or merchandising goods in the luxury class will feel the adverse conditions first and be hit the hardest. On the other hand, they report that industry in general has not been overproducing and that stocks on hand of raw materials and finished products are low enough for whatever period of retardation may take place. The purchasing power of the general public may decline somewhat, but the business papers editors do not believe that this will reach serious proportions or last very long.

The status of production and distribution, as portrayed by the latest available figures, gives no sign of general drastic curtailment as a result of the stock market deflation. Such curtailments as are reported are in many cases the result of high money rates—which condition has now been corrected—or are the result of an overproduction. General manufacturing as measured by the monthly consumption of electrical energy by the factories of the country in October was at a rate 3.9 per cent above October last year; engineering construction has declined steadily since May, the October lettings being 4 per cent under October, 1928; with money again available for mortgages, building operations on a large scale are anticipated; demand in the machinery and machine-tool industry is holding up well, and financially the country was never stronger and money is again flowing into trade and industry and is available at reasonable rates.

The railroads of the country anticipate that freight traffic and earnings may be reduced, but that by the middle of next year the stock market break will have a good effect on general business and railroad business in particular. In the building and construction field the editors are unanimous in holding that the break in stock prices will result in making investments in building operation distinctly attractive and that this after the temporary general decline is past will stimulate building and construction in all branches. Residential building which has been much below normal for a year will go ahead rapidly.

Concrete Pavement, Curbs and Sewers Break Bottleneck

At a cost of approximately $600,000 work was completed a few months ago on the widening of the Mission road south of San Francisco for a distance of 1.6 miles into a two-way traffic route with the street car tracks of the Market Street Railway Company in the center of the roadway. Originally the Market Street Company's tracks paralleled the highway which was only 24 ft. in width. Now with the completion of the project there are two 40-ft. concrete paved roadways with a 28-ft. strip between the two roadways providing space for the Market Street railway tracks. Thus there is now a two-way concrete paved traffic route with the street car tracks in the center, permitting three or four lines of automobile traffic in each direction, the slow moving vehicles being routed on the outside and the fast moving vehicles being routed toward the inside. The two roadways separated by the 28-ft. concrete curbed-in strip used by the Market Street railway does away with the confusion of two-way traffic, safeguards the traffic from street car interference and meets the requirements of the heaviest traffic of any highway in California—that of approximately 29,000 cars in a 16-hour count.

Mixing Plant Layout on Biloxi Bridge Job

The new bridge joining Biloxi and Ocean Springs, Mississippi, is scheduled to be completed during December. The concreting plant used on this job was mounted on a 32 by 92 ft. wooden barge and arranged so that materials from barges could be handled with the least effort. A derrick powered by a Mundy hoist and equipped with a ¾ yd. clamshell was used to load the aggregate from the barges to the Blaw-Knox bins and batchers.

Cement was handled in wheelbarrows direct from the cement barge to a shed back of the derrick by one or two men. A man in the shed loaded the cement bags into an elevator which discharged the load onto the mixer platform above. The ½-yd. mixer discharged into the concrete bucket which ran up the tower and delivered the concrete to the caps or floor system through a maximum of 50 ft. of chute.

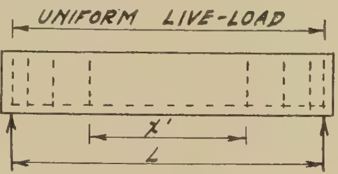
Reinforced Concrete Design Simplified

Chart E_1 (40; 50; 60; 75)
Web Reinforcing

By JAMES R. GRIFFITH
Professor of Structural Engineering, Oregon State Agricultural College

American Concrete Institute Building Code

$f_s = 20{,}000$ lbs. per sq. in.
$f'_c = 2{,}000$ lbs. per sq. in.
$n = 15$
Without Web Reinforcing
$v = 40; 60$ lbs. per sq. in.
With Web Reinforcing
$v = 120; 180$ lbs. per sq. in.
$f'_c = 2{,}500$ lbs. per sq. in.
$n = 12$
Without Web Reinforcing
$v = 50; 75$ lbs. per sq. in.



With Web Reinforcing
$v = 150; 225$ lbs. per sq. in.

$$x' = \frac{(\text{Allowable Shear})\ L}{(\text{Unit End Shear})}$$

CHARTS C, D-1, and D-2, as presented in the original series, were designed to solve general equations. They are applicable to the A. C. I. Code so require no revision.

In the original series, only 2,000-pound concrete was considered. In this series we are to consider both 2,000 and 2,500-pound concrete for beams. Since it became necessary to deviate from the simplicity of the three variable nomograph in order to include the concrete of higher strength, it was considered advisable to allow for the variation in stress for different conditions of anchorage. Chart E_1 (40;50;60;75) is therefore more general in application but less simple in use than the original Chart E (40).

The A. C. I. code allows the following unit web stresses:

Unit Shear (v)	$f'_c = 2{,}000$ $n = 15$	$f'_c = 2{,}500$ $n = 12$
Beams with no web reinforcement and without special anchorage of longitudinal steel	40	50
Beams with no web reinforcement but with special anchorage of longitudinal steel	60	75

Application of Chart E_1 (40; 50; 60; 75)

An isopleth was shown on Chart E (40) solving the problem:

Span (L) = 25 feet
Unit end shear (v) = 51.4 lbs. per sq. in.
Allowable shear without web reinforcing = 40 lbs. per sq. in.
Required web reinforcing for a distance (x) of 2.8 feet from each end of the beam.

I have shown the solution of this same problem on Chart E_1 (40;50;60;75) by isopleths (1 A) and (1 B). Unfortunately these two solution isopleths are very nearly coincidental. The right scale gives a value of ($x' = 19.5$ feet). Notice that in this case, for reasons explained later, the distance (x') found is the distance in the center of the beam requiring no web reinforcing. The distance requiring web reinforcing would be

$$x = \frac{25 - 19.5}{2} = 2.75 \text{ ft.}$$

This agrees very well with the value found previously.

In order to better illustrate the two necessary solution isopleths and show the effect of higher allowable web stresses, the same condition was solved with 50 lbs. per sq. in. as the allowable shear without web reinforcing. Isopleth (2 A) is drawn between the allowable unit shear of 50 lbs. per sq. in., and the span of 25 feet. Isopleth (2 B) is drawn through the actual end shear of 51.4 lbs. per sq. in., and the intersection of isopleth (2 A) and the support. This gives a value on the right scale of

$$x' = 24.3 \text{ ft.}$$

By slide rule

$$x' = \frac{50 \times 25}{51.4} = 24.3 \text{ ft.}$$

Or in terms of (x), the web reinforcing should extend a distance from the end of the beam of

$$x = \frac{25 - 24.3}{2} = 0.35 \text{ ft.}$$

This is such a small amount that in practical design it would be omitted entirely.

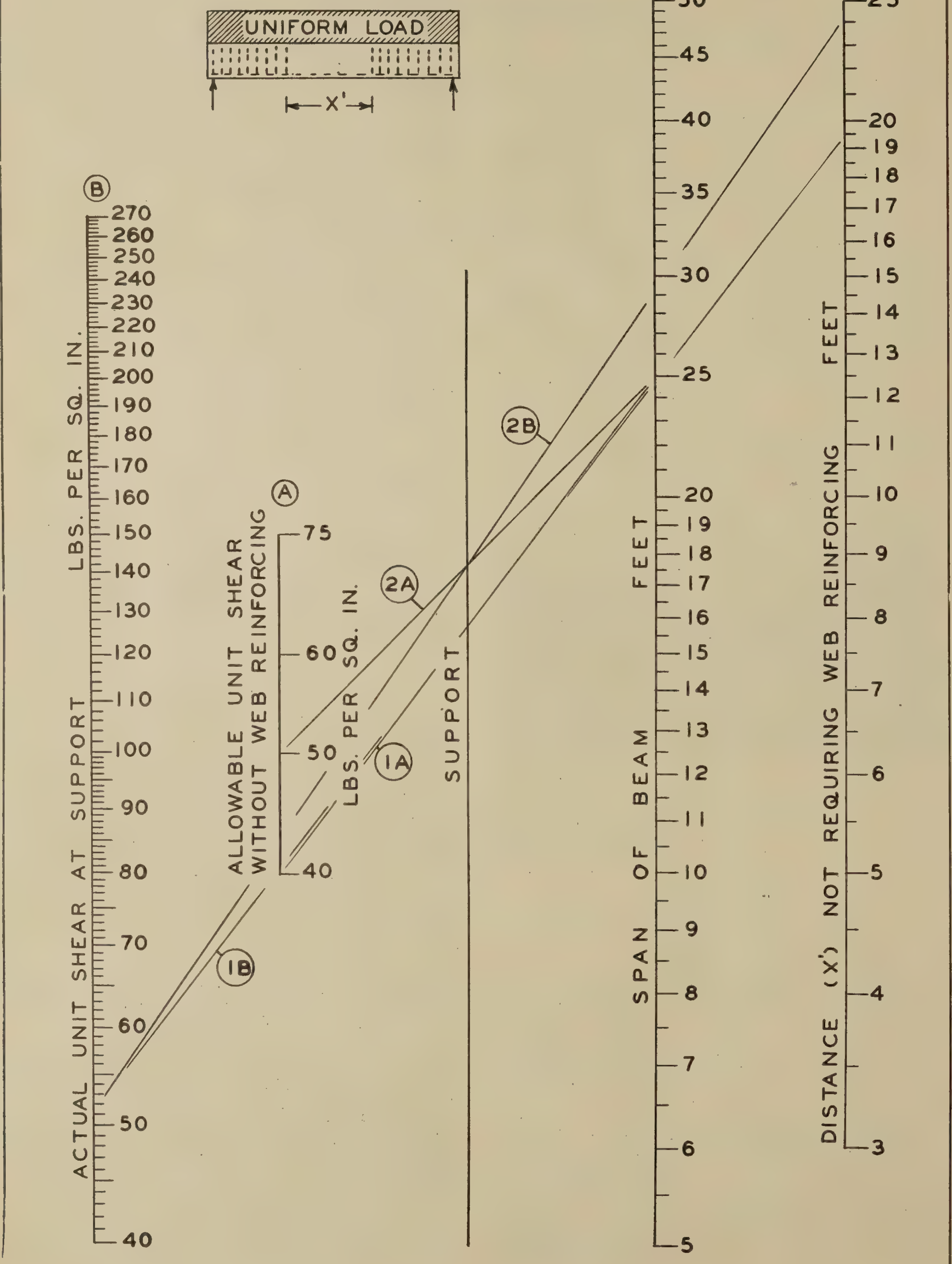
Fig. 1-E_1 is identical with Fig. 1-E of the original series except that the distance (x') has been added, and the general allowable shear (v') substituted for the shear of 40 lbs. per sq. in.

The equation as stated in the original series was

$$x = \frac{L\ (v - 40)/v}{2}$$

CHART E_1 (40; 50; 60; 75)

Web Reinforcing



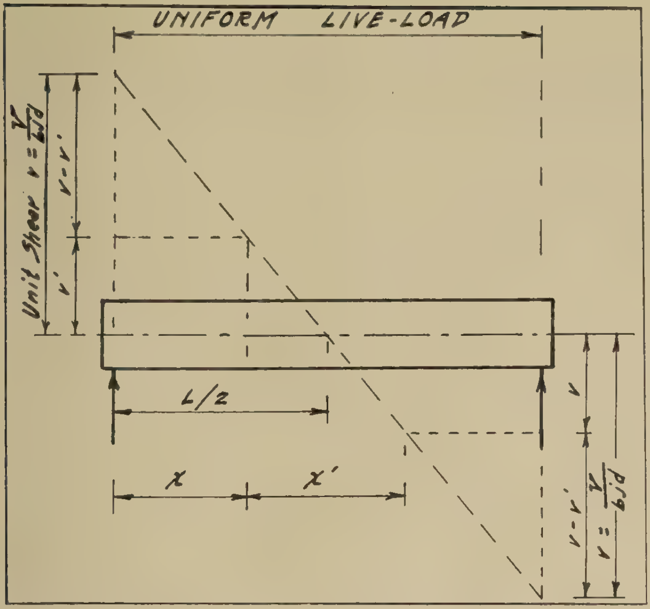


Figure 1-E_1

If the fourth variable is added, v' = allowable unit shear without web reinforcing, the equation becomes

$$x = \frac{L\,(v - v')/v}{2}$$

This can be transformed to

$$\frac{v'}{v} = \frac{L - 2x}{L}$$

In the last form it is still seemingly impossible for nomographic construction till we see that

$$L - 2x = x'$$

The equation, with this substitution, then becomes

$$\frac{v'}{v} = \frac{x'}{L}$$

This same result can be reached direct from Fig. 1-E_1 by similar triangles:

$$\frac{v'}{v} = \frac{x'/2}{L/2}$$

$$\frac{v'}{v} = \frac{x'}{L}$$

As stated in the title block

$$x' = \frac{(\text{allowable shear})\ L}{(\text{Unit end shear})}$$

$$x' = \frac{v'\,L}{v} \qquad \text{Eq. 1-E}_1$$

If this equation be written

$$x'\,v = v'\,L$$

and each side equated to a common variable (Z), the following two expressions will result:

$$Z = v'\,L \qquad (1)$$

$$Z = v\,x \qquad (2)$$

Each of these two expressions corresponds to the general expression

$$C = L^{mn/r} \cdot R^{m(1-n)} \qquad \text{Eq. 7}$$

Expression (1) was first considered. The D-10 scale was assumed for values of (v') and (L) making the ratio (r) equal to unity.

$$r = 1 = \frac{\text{size of } (R) \text{ co-ordinates}}{\text{size of } (L) \text{ co-ordinates}}$$

Substituting this value of ($r = 1$) and equating the actual exponents of expression (1) to the general exponents of Eq. 7, I have

$$\left.\begin{array}{r} mn/r = mn/1 = 1 \\ m(1\text{-}n) = 1 \end{array}\right\}$$

Solving these two expressions simultaneously, I obtain the values

$$n = \tfrac{1}{2}$$

$$m = 2$$

indicating that the nomograph (Fig. 1-E_1) will have the central (C) scale half way between the (L) and (R) scales. If the central (C) scale, for values of (Z) was to be calibrated, co-ordinates one-half the size used for the (L) and (R) scales would be used.

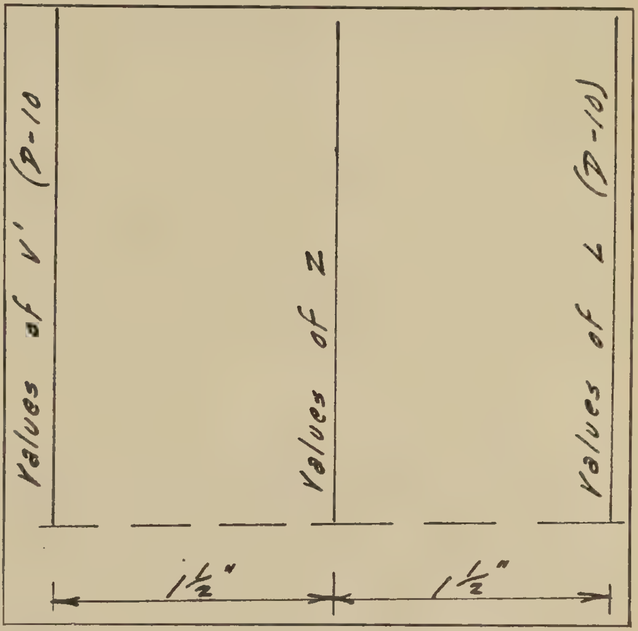


Figure 2-E_1

The exponents of the variables in expression (2) are identical to those of expression (1). So if the ratio ($r = 1$) be used for the nomograph of expression (2) as

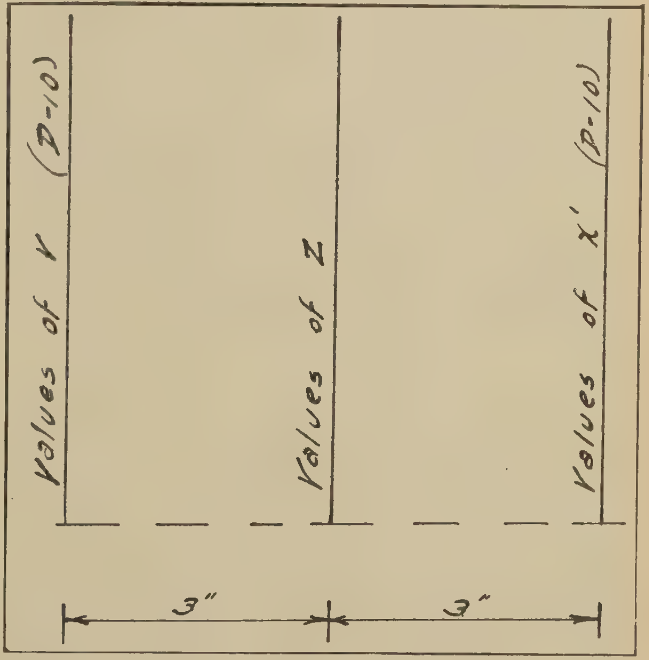


Figure 3-E_1

in that of expression (1), the following values will again hold true:

$$n = \tfrac{1}{2}$$
$$m = 2$$

In order to avoid the calibration of the central scale when superimposing the two nomographs, the (D-10) scale must again be used for the outside scales of this second nomograph, Fig. 3-E_1. If the two nomographs are now superimposed so that their central scales coincide, this common scale for values of (Z) will act as a support and require no graduations. Fig. 4-E_1 gives the complete information by which the original of Chart E (40;50;60;75) was plotted. While the scale for values of the allowable shear (v') had a value of 20 lbs. per sq. in. at the construction isopleth, only the four values were shown. While this could have been made a complete scale it would only have tended to add confusion.

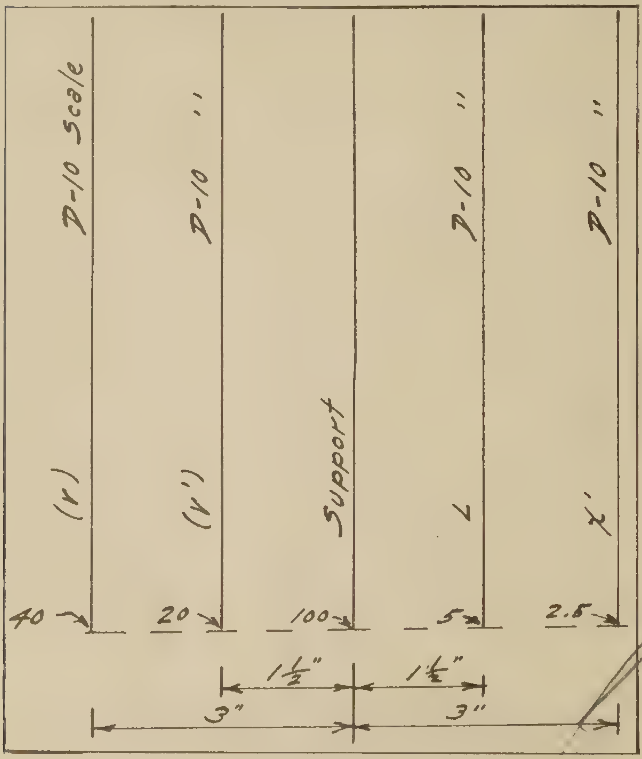


Figure 4-E_1

Concrete Institute Makes First Announcement of Program for New Orleans

With the annual American Concrete Institute meeting in the offing, a rough outline of what is in store for those concretors who will be in New Orleans February 11th, 12th and 13th is of interest.

Plans now being made provide for five technical sessions instead of the customary seven or eight. Each session will be strictly limited in its reports and papers to such subject matter and in such numbers as promise interesting discussion and available time for that discussion.

One session will consider the subject of curing concrete, including a paper by H. F. Gonnerman reporting a thorough and important investigation; a report from Committee 604, Winter Concreting Methods, R. C. Johnson, chairman, which will summarize good practice in concreting at low temperatures; one other report of allied interest, and the report of Committee 202, Variations in Standard Portland Cements, P. H. Bates, author-chairman, including the report as prepared by Dr. Bates and as discussed by critic members of the committee.

A session will be devoted to good practice in mixing and placing concrete and setting reinforcing steel. This will include the report of Committee 502, Arthur Lord, author-chairman, presenting the tentative draft "Recommended Practice for Mixing and Placing Concrete in Buildings," with discussion built up around the report to throw light on the rights and wrongs of prevalent practice. The committee on Fabricating and Setting Reinforcing Steel, 503, Wm. F. Zabriskie, author-chairman, will present a companion specification. Centrally mixed concrete and concrete mixed in transit will come in for examination through the work of two committees: 504, Specifications for Centrally Mixed Concrete, Miles N. Clair, author-chairman, and 602, Design and Operation of Central Mixing Plants, Frank I. Ginsberg, chairman.

Still another session will be devoted to papers of general interest but with special significance in the south on "Cementing Oil Wells" by J. F. Hough; the design and construction of the Bonnet Carre Spillway above New Orleans, to divert the Mississippi, by Capt. Helmer Swenholt, Corps of Engineers, U. S. A., "Design and Placing of Concrete Revetment Mat" by Lieut. Morris W. Gilland, Corps of Engineers, U. S. A., and on "Concrete Shore Protection Work on the Gulf Coast" by J. B. Converse.

Plant design and operating problems and the use of color are two outstanding general themes scheduled for discussion at a session on concrete products manufacture. The National Concrete Products Association will meet on the 10th, thus preceding the Institute convention.

One of the two open half days will be given to a Mississippi River trip, with a dinner climaxing the sessions.

Fairman New Eastern Manager for Cement Association

The Portland Cement Association announces the appointment of James R. Fairman to be manager of its eastern offices, with headquarters at 347 Madison Avenue, New York City, succeeding B. H. Wait, resigned.

Mr. Fairman is a graduate of the University of Missouri, and was engaged in bridge designing and general engineering work in Kansas City and vicinity for several years. He joined the field staff of the association there in 1919 and was appointed district engineer in charge of the Birmingham, Alabama, office in 1923.

Since December 1, 1925, Mr. Fairman has been manager of the southeastern offices at Atlanta, Georgia, and will continue to supervise association activities in the Southeast in addition to his new duties at New York.

~ *New Books* ~

Properties of Slag Concrete

TRANSVERSE STRENGTH AND ELASTICITY OF SLAG CONCRETE. Published by the National Slag Association, Cleveland, Ohio.

The conclusion reached is that the ultimate transverse strength of slag concrete is at least equal to that of other concretes, and in some cases higher, and "It is also probable that the size of the coarse aggregate has a bearing; a large piece of aggregate resting in the plane of cleavage will affect the beam's resistance to transverse strain considerably."

Concrete for the Builder

Some Actual Business Building Experiences:

Trowel Marker Distinguishes Shoemaker Work

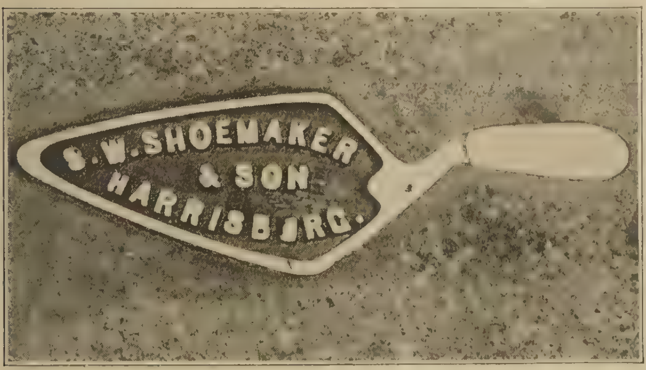
From builders of sidewalks to builders of million dollar structures is the story of S. W. Shoemaker and Sons, concrete contractors of Harrisburg, Pennsylvania.

The first concrete sidewalks in Harrisburg were laid on the state capitol gounds by a Philadelphia contractor in 1890. S. W. Shoemaker was among the group of people who marveled at this material and curiously watched it change from a stiff dough to a rock-like mass. It was not difficult to visualize the possibility of this material. In 1897 the capitol walks were as good as the day they were laid, and in 1898 the business of S. W. Shoemaker and Sons, cement contractors, was established. Although builders were skeptical, it was an established fact that the old board walks of the city were rotting out. Likewise, the stone flags were rather rough. The capitol walks were the proving ground that sold the people on permanence. To further assure the property owners that concrete was the ideal sidewalk material, Mr. Shoemaker placed a brass oval about 5 in. long in every sidewalk that he built.

Bids on this type of sidewalk varied from 20 to 25 cents per square foot. Many walks laid in 1898 are still in use and in as perfect condition as the day they were laid.

A son, Ray S. Shoemaker, decided in 1907 that the business needed a more distinctive marker. For this purpose he selected the mason's trowel. The new plate was unique. There was no confusing the work of S. W. Shoemaker with that of other contractors and the name again stood out prominently in the minds of Harrisburg's property owners.

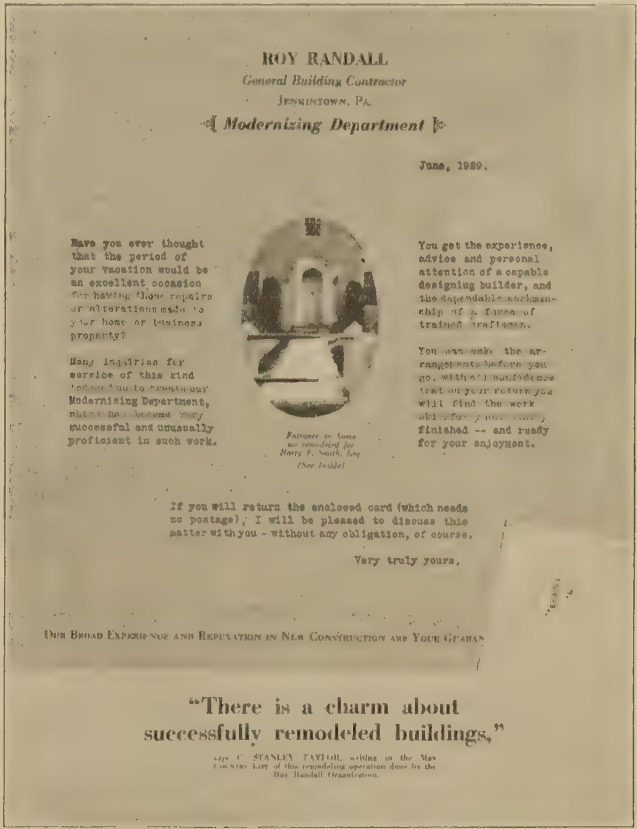
This emblem, attractive and unusual, together with S. W. Shoemaker's idea of doing work well, brought hundreds of thousands of dollars in volume to the organization of S. W. Shoemaker and Sons. One job advertised another until in 1919 the annual gross business in sidewalks, steps, foundations and other jobs typical of the concrete contractor was more than $150,000.



In 1920, Ray S. Shoemaker announced that the firm was ready to enter the structural field and had obtained a contract for building the million dollar south wing of the state capitol. At present the firm is building two buildings, one an office and the other a hotel, which have a total valuation of $4,000,000.

Developing Home Modernizing Business

In Jenkintown, Pennsylvania, there is a builder who handles a large volume of concrete contracting work each year largely through directing his advertising and sales efforts toward the larger property owners in his community. Roy Randall, who maintains a very attractive office and works with the leading architects in his territory, is responsible for this well-established business.



ROY RANDALL
General Building Contractor
JENKINTOWN, PA.

Modernizing Department

June, 1929.

Have you ever thought that the period of your vacation would be an excellent occasion for having those repairs or alterations made to your home or business property?

Many inquiries for service of this kind [illegible] to create our Modernizing Department, which has become very successful and unusually proficient in such work.

Entrance to home we remodeled for Harry F. South, Esq.
(See Inside)

You get the experience, advice and personal attention of a capable designing builder, and the dependable workmanship of a force of trained craftsmen.

You can make the arrangements before you go, with all confidence that on your return you will find the work [illegible] finished -- and ready for your enjoyment.

If you will return the enclosed card (which needs no postage), I will be pleased to discuss this matter with you - without any obligation, of course.

Very truly yours,

OUR BROAD EXPERIENCE AND REPUTATION IN NEW CONSTRUCTION ARE YOUR GUARAN

"There is a charm about successfully remodeled buildings,"

says C. STANLEY TAYLOR, writing in the May Country Life of this remodeling operation done by the Roy Randall Organization.

This company takes contracts for building concrete sidewalks, ash containers, basement floors, swimming pools, residence floors and farm buildings. To this list has been added remodeling work which is handled by a newly formed "Modernizing Department." The activity of this department is best described by the accompanying illustration, a reproduction of a circular mailed out to prospects for home modernizing. This folder, mailed with a business reply card, describes the modernizing work the company has done and can do.

Concrete for Permanence

Curing

The Five Requirements for Durable Concrete. (Summarized from Installment No. 1 in the June issue):

1. **Durable, impervious aggregates.**
2. **A watertight binding medium—the hardened cement-water paste.**
3. **A mixture that permits complete incorporation of the aggregates in the paste.**
4. **Methods of mixing and placing to secure a uniform homogeneous mass.**
5. **Adequate protection and curing.**

(Final Installment)

By F. R. McMILLAN

IN the previous installments, the need for proper curing conditions to attain a high degree of watertightness has been emphasized. In this installment the results of permeability tests on concrete and mortar are presented which show the important effect of moist curing on watertightness.

Fig. 8 shows the results of tests under a water pressure of 20 lbs. per sq. in. of mortar mixes of three different water-cement ratios in discs 1 in. thick. Each plotted point represents the average leakage of three specimens continued under test for a period of 48 hours. This leakage, which is expressed in cubic centimeters per hour per square foot, is plotted against the age of the specimen at the time it was subjected to test. The relation between the leakage and the age is seen to be expressed by a regular curve, showing rapid increase in watertightness with length of moist curing, there being a separate curve for each mixture.

Fig. 9 shows a similar diagram representing the tests on concrete mixtures of two different water-cement ratios. These specimens were 2 in. thick, tested under a water pressure of 40 lb. per sq. in. for a period of 48 hours. As in the case of the mortar specimens of Fig. 8, the watertightness is seen to increase rapidly as the number of days in the moist room is increased. From these data it can be seen that the watertightness of a concrete or mortar can be increased either by a longer period of curing or by the use of a lower water-cement ratio.

In some tests which formed a part of this investigation, it was found that for these thin specimens, there was little or no increase in watertightness for storage in a dry atmosphere following the period in the moist room. Such an abrupt change has not been found in tests of compressive strength and other properties where, because of their shape, the specimens are much better protected against complete drying than these thin discs. It may be assumed, therefore, that for the same moisture and temperature conditions, the greater mass of concrete ordinarily used in structures would show a better development of watertightness following the moist curing period than that found for these thin specimens.

In the application of these data to the problem of producing watertight concrete in the field, it is evident that the selection of a water-cement ratio for a particular condition of exposure cannot be made intelligently unless it can be known in advance what curing conditions are to prevail. This was brought out in Installment 4 where a table of "Recommended Water-Cement Ratios" was given. In this table, the assumption was made of a period of curing equivalent to 10 days in the moist room at 70 deg. F. It can be seen from Figs. 8 and 9 that such curing will give a very satisfactory watertightness for mixes less than 7 gal. per sack, and that for mixes of higher water ratios, additional curing must be supplied if a high resistance to freezing is necessary. It can be seen from these diagrams also that where satisfactory curing for periods up to 10 days cannot be secured, lower water ratios must be selected for equivalent resistance.

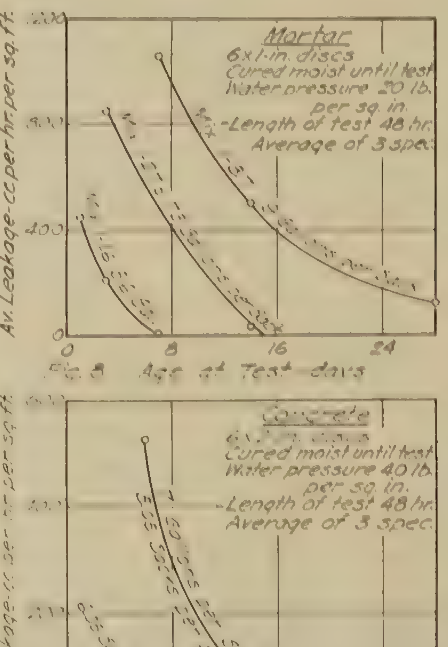


Fig. 8

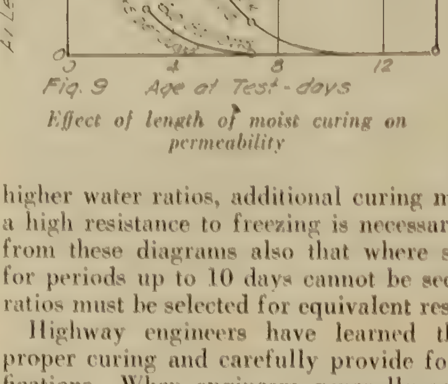


Fig. 9

Effect of length of moist curing on permeability

Highway engineers have learned the importance of proper curing and carefully provide for it in their specifications. When engineers generally recognize the value of extended curing, particularly in the building up of an internal structural to resist the penetration of water and the destructive effects of repeated freezings, the practice of thorough protection against loss of moisture during the early period will become general.

Basement Walls and Floors

Hints for the Builder of Basement Walls and Floors—Watertight Concrete Is Important Essential

As every concrete builder knows, a fundamental requirement of permanent building is a permanent foundation. To be permanent, it must be strong, fireproof, rotproof and, above all, watertight. Likewise, basement floors must meet the same requirements to be entirely satisfactory.

For basement walls, concrete construction, either solid concrete (monolithic) or concrete masonry, is generally accepted as standard. Such walls can be made watertight, insuring dry interior surfaces, which may be plastered, stained, painted or given a variety of other attractive and inexpensive treatments that are so helpful in making basement rooms cheerful and usable. Making the basement livable means designing and building the floor, walls and ceiling so that they will be dry, clean, sanitary and of attractive appearance. Concrete builders every day are assuring home owners that these requirements are fully met through the use of concrete. Concrete floors may be colored, marked off into patterns or given any of the attractive finishes commonly used in connection with concrete floors in above grade construction.

Whether the structure is a small cottage or a large mansion, concrete footings, foundations and basement floors are necessities. This is true whether the structure is being modernized or is being built new.

Concrete Footings

Monolithic concrete footings are the most satisfactory for all types of foundation walls. Such footings provide an even surface on which to start the wall proper. They also provide increased bearing area on the soil, thus insuring against settlement.

In determining the width of footings, the character of the soil as well as the weight of the building and its contents must be taken into account. The footing is made wide enough to spread the load over sufficient area to be safe against settlement. Safe loads for various soils are given in the following table:

Class of Soil	*Carrying Capacity Tons per sq. ft.*
Soft Clay	1
Wet Sand and Firm Clay	2
Fine and Dry Sand	3
Hard Dry Clay	4
Coarse Sand	4
Gravel	6

"Dead" load, as the weight of the building is commonly called, is computed by adding together the weight of various portions of the structure. The following weights, although approximate, are sufficiently accurate for figuring "dead" loads in order to compute the size of footing required:

A monolithic concrete wall 8 in. thick weighs about 100 lbs. per sq. ft. of wall area; 12 in. thick, about 150 lbs. per sq. ft. of wall area. Concrete block walls 8 in. thick weigh about 70 lbs. per sq. ft. of wall area. An 8-in. wall built of concrete building tile weighs about 50 lbs. per sq. ft. of wall area. Lumber used in buildings commonly weighs from 2 to 4 lbs. per board foot. Brick masonry averages 140 lbs. per cu. ft.

"Live" loads, those imposed upon the foundation by the contents of the building, are determined largely as a matter of personal opinion based on experience. Building ordinances often specify minimum "live" loads allowable in the design of floors and in such cases these values are used in computing loads on the foundations. These loads vary with the occupancy of the building. Thus, 400 lbs. per sq. ft. of floor area may be the requirement in designing a warehouse for storing hides, while an ordinary dwelling is unlikely to be called upon to carry one-tenth of that amount. Most building codes specify 30 to 40 lbs. per sq. ft. as the "live" load for floors in dwellings. School house floors generally are designed for a "live" load of 50 lbs. per sq. ft. Roof "live" loads are taken at around 20 or 30 lbs. per sq. ft., depending upon the amount of snowfall common in the community.

Concrete footings should be leveled and formed as carefully as the walls that rest on them

For structures of the type usually built by concrete contractors, a safe design is to make the footing twice as wide as the wall is thick and projecting equally on both sides. (See Section A-A in Fig. 1.) This recommendation, of course, is for structures which put no great load on the footings. The depth of the footing should be twice the projection. If the building is on a property line or adjoining another structure, it may be necessary to construct a footing similar to that shown in Section B-B, Fig. 1, projecting only on one side of the wall. Under heavily loaded columns the footings are "stepped down" as shown in Section C-C of Fig. 1. Note that the projection is one-half the column thickness, and that the depth of each step is twice its projection. "Stepping-down" of footings saves concrete, yet gives the desired spread.

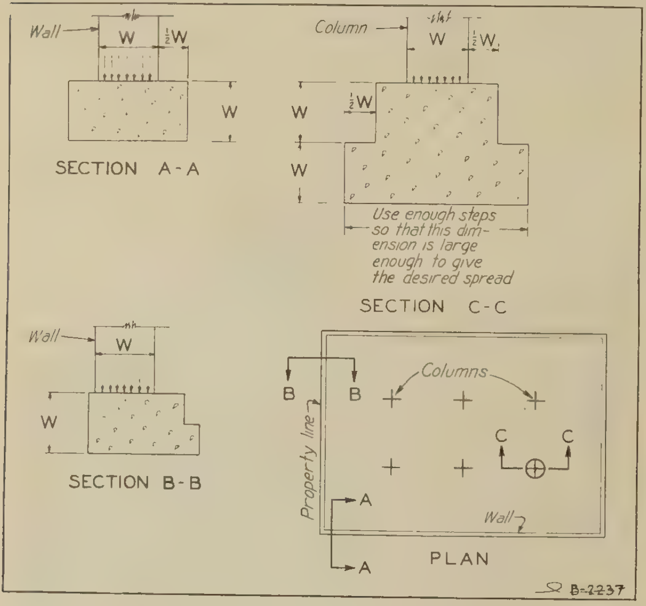


Fig. 1. General guide for the design of simple concrete footings

Dimensions of Foundations and Footings

For all types of foundations it is essential to extend the foundation below possible frost penetration even though firm soil is found at a shallower depth. The foundation then will not be upheaved by freezing. In general, common practice in the community is the best guide to the depth required to get below the frost line. In some districts frost penetrates as deep as 6 ft.

Dimensions of foundations and footings vary, of course, for different classes of construction. For example, under the foundation walls of a barn a concrete footing 2 ft. wide and 12 in. deep usually will be sufficient. Small residences generally require footings 18 in. wide and 12 in. deep. Footings 12 in. wide and 8 in. deep will serve to support private garages, summer cottages, tourist camp buildings and similar light structures. Foundation walls enclosing basements, such as for small and moderate-sized residences, generally are from 8 to 12 in. thick.

Forms for Monolithic Foundations

For small structures without basements the earth wall of the foundation trench may serve as forms for the concrete if the earth is of a type that does not cave readily. The trench should be excavated carefully with sides even and vertical. The bottom should be leveled and properly widened to receive the footing.

In caving soil, however, and under structures requiring a basement, it is necessary to construct forms to receive the concrete. The forms should be rigid and well braced in order to withstand the pressure of wet concrete and produce a straight, even wall without bulges or depressions. As wet concrete weighs about 150 lbs. per cu. ft., form sheathing as well as posts and studs must be strong enough to withstand pressure due to this weight. For walls not over 12 in. thick, 1-in. boards restrained at 24-in. intervals ordinarily will withstand the pressure of concrete 3 ft. deep without bulging. A 2-in. plank (nominal size) will be safe against bulging under the load with supports at 40-in. intervals. For deeper or thicker sections of walls, posts are placed closer together or heavier form boards are used.

Posts or studs for supporting form boards or sheathing must hold forms in a true line; 2 by 4's or 2 by 6's are usually satisfactory for this purpose. These may be strengthened at intervals by wire ties run through the forms. For keeping inside form surfaces the proper distance apart, wood "spacers" or "spreaders" of a length equal to the desired wall thickness are placed between the forms before wire ties are tightened. As forms are filled with concrete the spreaders are removed.

Showing wooden forms built in sections or panels. These forms would be more convenient if made in sections half as long

Forms should be constructed so that, if it is desired to use them again or to use the lumber for other work, they can be "knocked down" with but little damage to the lumber. This is often accomplished by the use of screws or special double-headed nails instead of common wire nails for holding forms together. Stock lengths of lumber often can be utilized without cutting. In this case lumber needed for other portions of the structure can be used first for form lumber.

Wooden forms, when built in sections known as "panels," are easily erected and removed and may be used many times. However, sections should not be too long or too heavy for two men to lift.

To prevent concrete from sticking to forms, crude oil, soft soap or whitewash should be painted on the form surfaces that will come in contact with the concrete. Oil drained from automobile crankcases is satisfactory for this purpose. Surfaces should be treated each time the forms are used.

Typical forms for concrete foundations are shown in Figs. 2 and 3.

Retaining Walls

For most residences and similar buildings, plain monolithic concrete walls have strength sufficient to withstand ordinary soil pressure. Likewise, concrete masonry is suitable for construction of foundation and basement walls in residences and small buildings, and such walls usually are made of one thickness of block or tile, from 8 to 12 inches through. Walls of deep cellars and hill-

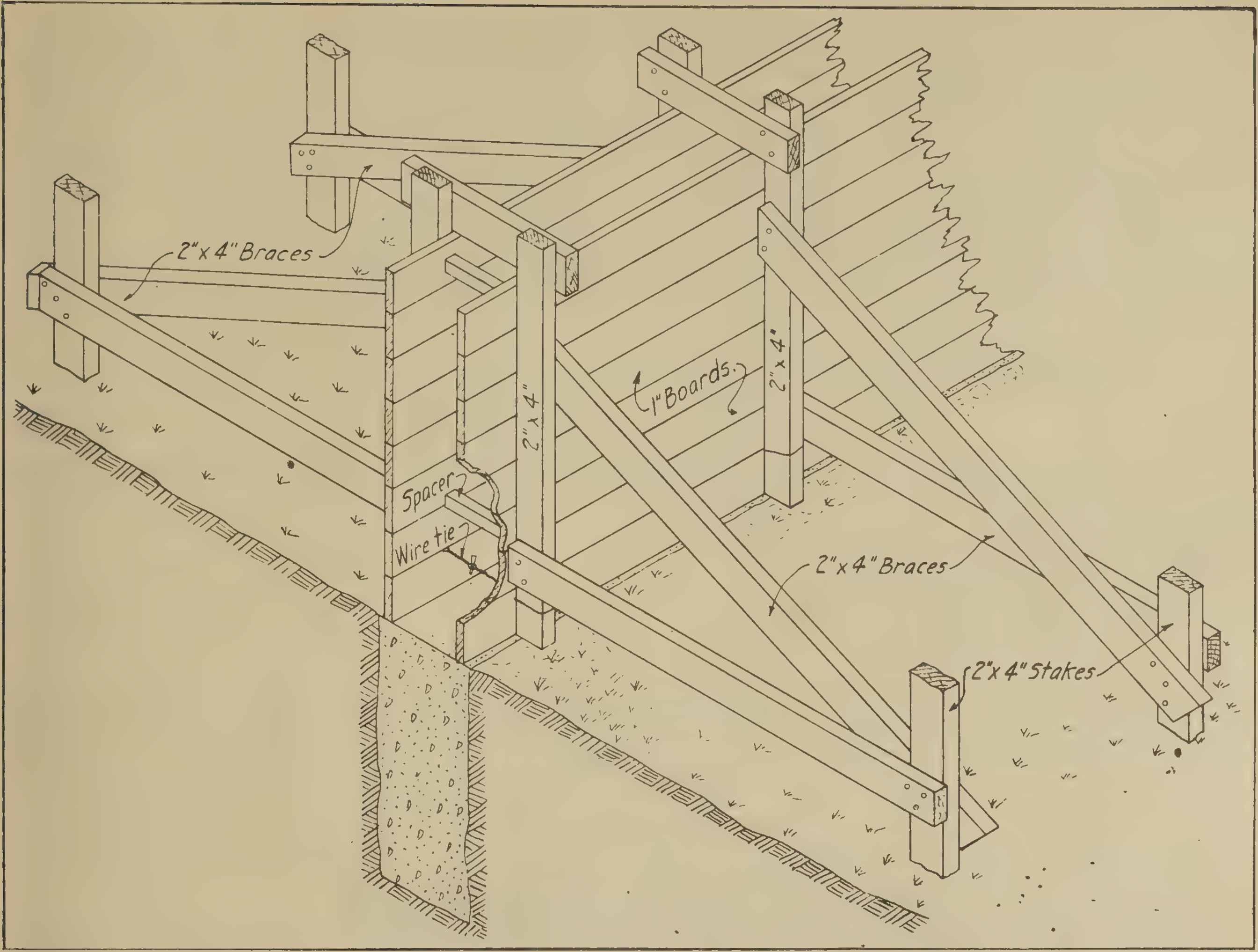


Fig. 2. Forms for monolithic concrete walls above grade. Where the soil is firm enough, no forms are needed below grade

side locations, however, often are subjected to heavy side pressure of soil. In such cases the foundations may be designed as gravity walls or as retaining walls. Careful design is essential, and if the builder is not familiar with the principles of structural mechanics he should consult with a competent structural engineer.

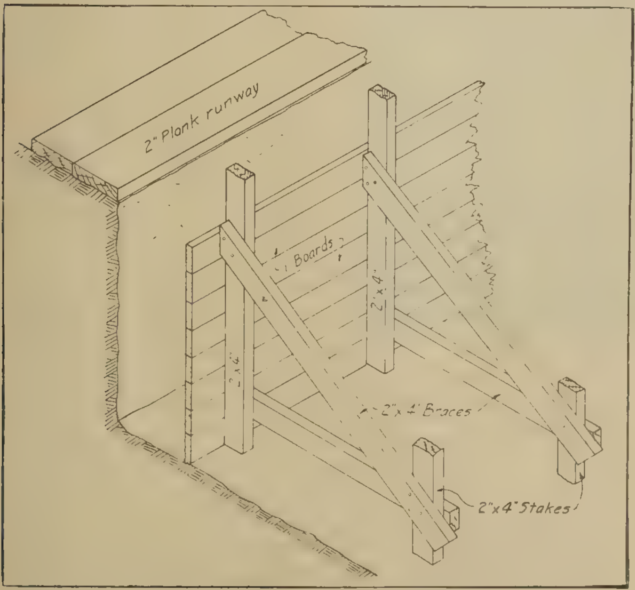
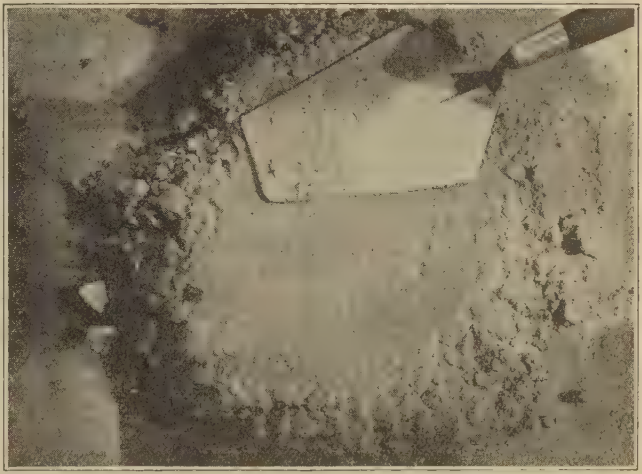


Fig. 3. Forms for concrete foundation walls where the embankment serves as the outer form



A workable concrete mix will take on this appearance with light troweling

Correct Concrete Mixes

For ordinary foundation conditions, except where the walls enclose basements, concrete which attains an ultimate compressive strength of 2,000 lbs. per sq. in. at 28 days generally is recommended. The approved mix for 2,000-pound concrete is one containing 7½ gallons of water (with aggregates that are thoroughly dry for each sack of cement). (Use 6 gallons with moist aggregates and 5 gallons if aggregates are dripping wet.) As a trial batch, combine 1 sack cement, 3 cu. ft. sand and 5 cu. ft. gravel or crushed stone (1:3:5 trial mix), using quantities of water previously specified. If this produces a mixture that is too wet, add more sand and coarse aggregate. If too stiff a mix results, use less aggregates in succeeding batches. Do not vary the amount of mixing water except as given. The following table gives recommended concrete mixtures for foundation walls and basements:

RECOMMENDED CONCRETE MIXTURES FOR FOUNDATION WALLS AND BASEMENTS

Kind of Work	Strength in pounds per sq. in. at 28 days	Gallons of water to add to each one-sack batch: Dry Sand and Pebbles	Moist Sand and Pebbles	Wet Sand and Pebbles	Trial Mixture for first batch: Cement	Sand	Pebbles	Maximum aggregate size (inches)
Basement floors, steps, corner posts, piers, columns	3,300	5½	4¼	3¾	1	2	3	1
Water-tight basement walls and pits	2,700	6½	5	4¼	1	2½	3½	1½
Foundation walls which need not be water-tight, mass concrete for footings, retaining walls, engine bases	2,000	7½	6	5	1	3	5	2

Aggregates usually are moist and sometimes are dripping wet. In either case the amount of mixing water is reduced by the quantity present in sand and coarse aggregate because the moisture present in the aggregates is free to act on the cement. A cubic foot of moist sand holds about a quart of water, while as much as a gallon may be contained in aggregates that are dripping wet.

Watertight Concrete Walls and Floors

Where the foundation is located in poorly drained soil or is to form the enclosure for a basement or cellar, watertight concrete is desirable. This is especially true at the present time for there is an increased demand for basements that can be made livable. Such basements must be dry to insure the desired comfort, making it important that the walls be watertight.

The recommended mix for watertight concrete is one containing not over 6½ gallons of water per sack of cement. In this case a trial batch contains aggregates in the proportions of 2½ cu. ft. sand and 3½ cu. ft. of coarse aggregate such as gravel or crushed stone, varied to give a workable mix. A workable mix, as shown in an accompanying photograph, is one that can be placed readily in the forms without separation of ingredients, and that with spading or tamping will fill all angles and corners of the forms. In a workable mixture there is sufficient cement-sand mortar to give smooth surfaces, free from rough spots, called honeycombing, and to combine the pieces of coarse aggregate into a mass that will not separate out in handling. In proportioning sand and coarse aggregate, amounts of each may be varied as required to produce a workable mix, but water should be used exactly as given in the foregoing table.

There are a number of admixtures on the market that are helpful in securing watertightness when used according to the manufacturer's directions. These may be used for additional security. They do not take the place of careful workmanship.

For basements, it costs much less to build a watertight wall than to repair a leaky one. Consequently, the time to make a wall watertight is when it is built. For concrete masonry foundations in ordinary well-drained soil, a very important precaution is to see that joints are well filled with portland cement mortar and carefully pointed. It is not always easy, however, to get first-class workmanship, and in heavy, water-logged soil the pressure of water may be great enough to force its way through construction seams. The following precautions, as illustrated in Fig. 4, will guard against possibility of leaks developing through defective joints. Similar methods are used for repairing leaky basements, work which the concrete builder can do at odd times to keep his crews busy. A line of concrete drain tile is placed entirely around the outside of the footing and is connected to a suitable outlet. The excavation above the tile is filled within a foot of the grade line with soil, cinders or some other material of a porous nature to provide a fill that will allow water to seep through quickly. When the foundation is erected near another so that it is impossible to run a line of tile around the outside, the tile may be placed on the inside of the footing and slightly below it. When there is considerable water in the soil it is often advisable to place lines of tile both inside and outside the footings.

As a further precaution in securing a watertight basement wall, two or more coats of portland cement plaster may be applied to the outside surface as soon as wall forms are removed or, in the case of a concrete masonry wall, just as soon as the mortar joints have hardened. The plaster is mixed in the proportions of 1 part cement and 3 parts mortar sand. No lime should be used in plaster which will be in contact with the soil. Before

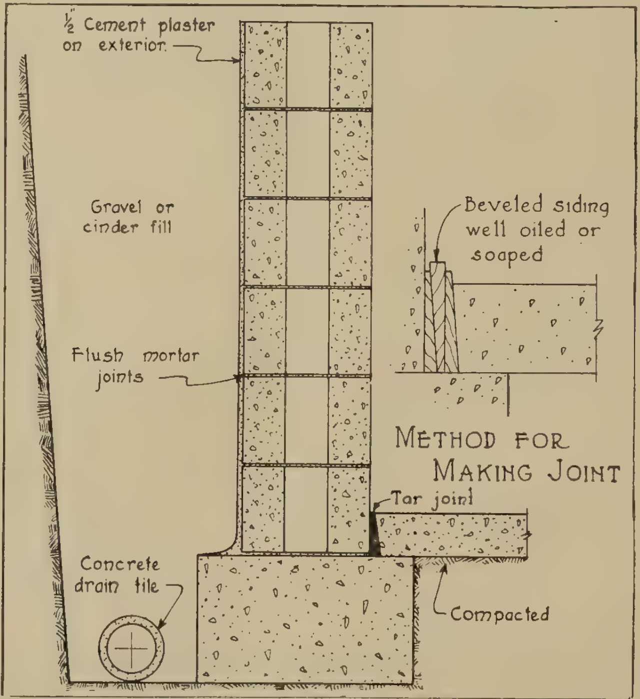


Fig. 4. A concrete masonry basement wall which has been protected against external water by proper drainage, a coating of portland cement plaster over the masonry and watertight joints between the floor and the wall

applying the plaster, the surface should be dampened evenly to obtain uniform suction.

Basement Floors

Concrete floors in basements should be at least 4 inches thick. A 5 or 6-in. slab is desirable if unusual loads are to be supported and, where pressure of ground water is heavy, an even greater thickness is recommended. In the latter case, steel reinforcement is used to strengthen the floor slab. One-course construction is recommended for basement floors. This term indicates that the same mixture of concrete is used for the full thickness of the floor.

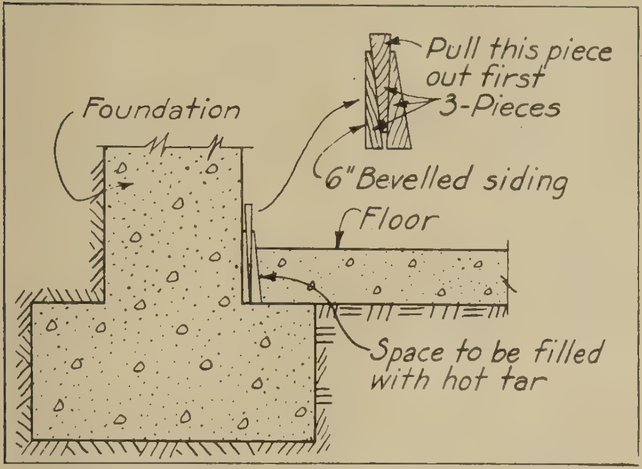


Fig. 5. Showing watertight method of placing concrete floor on footings. Note form for making wedge-shaped joint

The recommended mix for floors is one containing 5½ gallons of water (with aggregates that are thoroughly dry) per sack of cement. (Use 4¼ gallons with moist aggregates and 3¾ gallons if aggregates are dripping wet.) As a trial batch, combine 1 sack cement, 2 cu. ft. sand and 3 cu. ft. coarse aggregate, using quantities of water specified. If this produces a mixture that is too wet, add more sand and coarse aggregate. If too dry a mix results, use less aggregates in succeeding batches. Do not vary the amount of mixing water except as given previously.

The concrete floor slab commonly is placed directly on the earth. On soil which is water-logged, however, a fill of cinders or gravel 4 to 6 inches thick and properly drained should be placed to provide a dry base for the concrete. In either event, the base for the floor must be thoroughly compacted.

Fig. 5 shows a watertight method of placing a concrete floor on the footings. A wedge-shaped joint of tar insures against seepage of water from beneath the floor.

Finishing the Floor

The surface of concrete basement floors should not be finished at once, but given time in which the concrete can stiffen slightly after it has been placed and brought to the proper level by screeding. An attempt to finish at once may produce a film of mortar on the surface which has a tendency to crack off or check. The proper time to finish the floor is when the concrete has stiffened somewhat but is still workable. Finishing is performed with a wooden float. With this tool, concrete is provided with a gritty, non-slip surface. Where a very smooth surface is desired, a steel trowel is applied to the floated surface. The steel trowel forces sand particles down into the mass, tending to compact the concrete and leave the surface smooth.

Where the location of the basement is such that the ground water level is likely to rise above the floor level, further precautions should be taken to prevent leakage. The construction becomes similar to the building of a tank except that external and not internal pressure must be taken into consideration. It may be necessary to make the walls thicker and to place reinforcement in the walls and floor. Such cases require special design for walls and floor and should be handled by an experienced structural

A typical monolithic or solid concrete foundation after forms have been removed engineer. Extra waterproofing precautions are particularly desirable in such cases.

Aggregates for Concrete Walls and Floors

Aggregates for making concrete (sand and gravel or crushed stone) should be clean and hard, free from fine dust, loam, clay or vegetable matter. Sand should be evenly graded from fine up to ¼ in. Coarse aggregate should be well graded in sizes ranging from ¼ in. up to 1½ or 2 in., depending upon the thickness of the foundation wall or floor. In general, the larger pieces of aggregate should not exceed one-third the thickness of the section of concrete being placed. The natural mixture of sand and gravel as taken from the gravel bank, usually referred to as bank-run material, seldom is suitable for concrete unless first separated and then recombined in correct ratio. This is also true of material taken directly from crushers.

Placing and Curing Concrete

For foundations, after the concrete has been mixed thoroughly, it is deposited in the forms in 6 to 12-in. layers and in a continuous operation, if possible, to avoid construction seams. The concrete will be rather stiff, requiring some tamping to get it to settle into the forms. A spade or thin board sharpened at one end may be used for working the concrete next to the form faces to obtain smooth, even surfaces. This operation pushes large pieces of aggregate away from the surface and releases any air that may have been entrapped when the concrete was placed.

It is well to complete a foundation or wall in one day's operation, if possible, in order to prevent construction seams. If it is necessary to stop work before a wall can be finished, the concrete should be leveled in the forms and the surface roughened by scratching it or by placing large pieces of aggregate in it projecting about half way out of the concrete. This will help to obtain a good bond between the old and new layers of concrete when work is resumed. Before depositing an additional layer of concrete, the roughened surface should be scrubbed with clean water to remove any dirt or scum and just before placing new concrete it should be painted with cement and water mixed to the consistency of thick cream. Forms may be removed as soon as concrete has hardened sufficiently to be self-sustaining. In warm weather, one or two days provides enough time for concrete to harden so that it will stand by itself.

Concrete floors should be one-course construction and it is well to complete the job in one day.

Moisture and heat are necessary for the proper hardening of concrete. If this fact is kept in mind, no difficulty will be encountered in the proper curing of footings, foundations and basement floors. Wall sections should be covered with moist canvas or burlap. Floors may be covered with wet sand or straw.

Estimating Quantities

Quantities of cement, fine aggregate and coarse aggregate required for 100 sq. ft. of surface for varying thicknesses of foundations or floors are given in the following table:

C. = Cement in sacks.

F. A. = Fine aggregate (sand) in cu. yds.

C. A. = Coarse aggregate (pebbles or broken stone) in cu. yds.

Quantities may vary 10 per cent either way, depending upon character of aggregate used.

No allowance made in table for waste.

Proportion	1:2:3			1:2½:3½			1:3:5		
Thickness in Inches	C.	F.A.	C.A.	C.	F.A.	C.A.	C.	F.A.	C.A.
3	6.5	.48	.71	5.5	.50	.71	4.3	.48	.79
4	8.6	.64	.96	7.3	.67	.94	5.7	.63	1.05
5	10.8	.80	1.19	9.1	.84	1.18	7.1	.79	1.32
6	12.9	.96	1.43	10.3	1.01	1.42	8.5	.95	1.58
8	17.2	1.27	1.91	14.6	1.35	1.89	11.4	1.26	2.11
10	21.5	1.54	2.38	18.2	1.68	2.35	14.2	1.58	2.63
12	25.8	1.91	2.86	21.8	2.02	2.82	17.0	1.89	3.16

(Note.—Quantities required to produce a cubic yard of concrete may be computed readily from the above table.)

Concrete Contractor Conferences

SCHEDULE OF MEETINGS FOR DECEMBER

ILLINOIS

City	Date	Place
Waukegan	Dec. 2	Karcher Hotel
Rockford	Dec. 4	Nelson Hotel
Elgin	Dec. 6	Fox Hotel
Aurora	Dec. 9	Leland Hotel
Joliet	Dec. 11	Louis Joliet Hotel
Peoria	Dec. 13	Pere Marquette Hotel
Springfield	Dec. 16	Associated Building Contractors' Club
East St. Louis	Dec. 20	Broadview Hotel

MICHIGAN

City	Date	Place
Detroit	Dec. 9	Concrete Prod. Assn. Laboratory, 12241 12th St.
Jackson	Dec. 11	Elk's Club, Jackson & Wesley Sts.
Lansing	Dec. 13	Engineering Bldg., Michigan State College
Grand Rapids	Dec. 16	Y. M. C. A.
Muskegon	Dec. 18	Y. M. C. A.
Kalamazoo	Dec. 19	Carpenters' Hall, 326 N. Rose St.

WISCONSIN

City	Date	Place
Milwaukee	Dec. 9	Contractors in each of the Wisconsin cities can obtain information on their local meeting places from the Master Builders' Association in their city.
Sheboygan	Dec. 11	
Green Bay	Dec. 13	
Oshkosh	Dec. 16	
Madison	Dec. 18	
Kenosha	Dec. 20	

All of these conferences will begin promptly at 7:30 o'clock in the evening on the dates and at the places given in the above program.

The Portland Cement Association has scheduled meetings for concrete contractors in Illinois, Michigan and Wisconsin during December for the purpose of discussing methods of getting business, financing, construction and creation of new markets. Complete schedule of these conferences is given above.

The illustrated material to be presented will be of interest to all concrete contractors who do monolithic work except those who build concrete roads and large reinforced concrete buildings exclusively. Illustrations and information to be presented were obtained from many leading contractors. The story will be told of how these men are solving their problems, developing new markets and increasing their business. In fact, from these men much valuable first-hand information has been obtained concerning the concrete contracting business. Among the points to be discussed are: the kind of work that is being done by the most enterprising contractors, the short cuts they have found in getting work, and successful methods of financing jobs.

All concrete contractors and building material dealers are invited to attend these meetings, which promise to be worthwhile. Meetings will also be held in other states at later dates. Those for January, February and March will be announced later in these pages.

Modern Stucco and Plaster

A Discussion of Standard Practice in Application of Portland Cement Stucco and Plaster

Typical Portland Cement Stucco Textures—Common Plastering and Texturing Tools

(Installment V)

Note: The accompanying descriptions and illustrations continue and conclude the instructions for applying stucco textures which began in the November issue.

Installment VI, which will appear in the January issue, will describe methods of applying portland cement plaster and bring the entire series, "Modern Stucco and Plaster," to a close.

Californian Texture

The mortar for this texture is spread in applications similar to those used in creating the Spanish. Full trowels of mortar are spread in all directions and allowed to remain as placed without additional smoothing. There are no straight-line markings, as a rounded trowel is used and curved strokes are employed. Before the mortar hardens, its surface is rubbed down with a wadded piece of burlap to produce a wavy, irregular surface having a coarse texture. The final treatment consists of troweling the entire area. This operation creates highlights throughout the surface. These are in contrast to the relatively coarser texture of the deeper areas. Troweling also tends to force sand particles into the mortar, compacting the surface. The finished appearance gives an effect like that obtained in plastering over an irregular surface, with the added touch of highlights here and there resulting from the final troweling.

Italian Texture

This texture is created with a spatter-dash finish applied on a thin under-coat. The dash coat is troweled to give contrasting smooth and rough areas. Polychrome finish can be secured by using differently colored mortars in the under-coat and the dash. A very thin coat is first troweled on the wall. This insures uniform color over the entire surface, even though the dash coat may not give complete coverage. Then small quantities of mortar are dashed on with quick strokes of a whisk broom. A bundle of reeds may be used for a slightly different effect. Since a spatter-dash coat hardens rapidly, not more than thirty square feet of wall should be covered at a time, and then finished before any hardening occurs. Finishing is best accomplished by placing the trowel flat against the partially set dash coat and drawing it evenly across the face of the wall from left to right. A smoothing return stroke may be made to erase possible trowel marks. Variations will occur in this texture according to the time elapsing between dashing and troweling. Consequently this time should be constant for uniform appearance.

English Cottage Texture

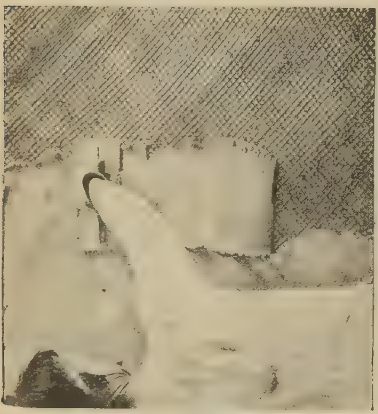
This texture is created by feathering the stucco with the edge of the trowel into irregular wavings and surfaces. A preliminary coat is applied about ⅛ in. thick. Portions of this coat are left exposed in the finished work and other portions provide plastic surfaces on which to spread additional mortar used for creating the irregular finish. Small amounts of mortar are then applied with the trowel, using short, twisting strokes at varying angles to the wall, avoiding vertical or nearly vertical strokes. By twisting the trowel as the pat of mortar is applied, slightly curved ridges will be formed. Variations of this texture are obtained by varying the amount of mortar, the directions and length of trowel strokes and the pressure and twisting motion given the trowel. Heavier applications are sometimes desirable.

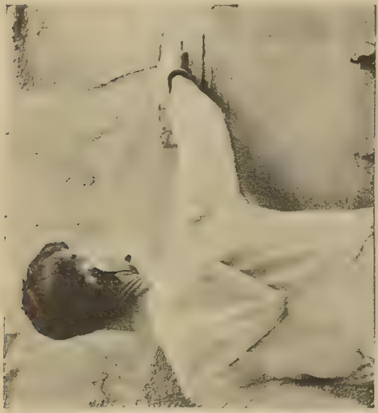
An Alabama home with walls built of concrete masonry and covered with portland cement stucco in the English cottage texture

Modern American Texture

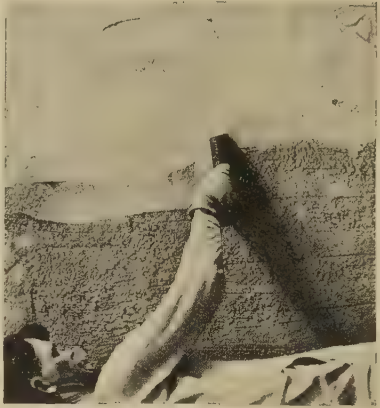
This rough-torn texture is created by the use of a heavy coat of mortar with its face roughened or torn in a vertical direction. The mortar is applied approximately ¼ in. thick, no special effort being made to remove trowel marks. Then the surface is rough-torn by drawing the edge of a wood block up the face of the wall. A downward stroke should never be used in tearing the surface. The block should be tilted at an angle with the wall as it is drawn up. A variety of straight or wavy effects is possible. To tear the surface lightly, the board may be held in one hand; if a heavier texture is desired, both hands should be used. The different holds on the board and positions best suited to create an evenly-torn surface will come with practice. This texture can be given an interesting tapestry effect by lightly drawing across its surface a brush dipped in a pigment of different color than that used in the mortar.

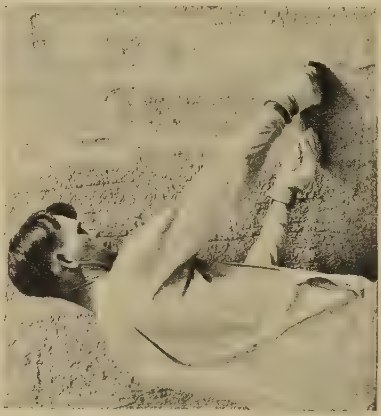
A Few of the Textures Possible


1. The covering application

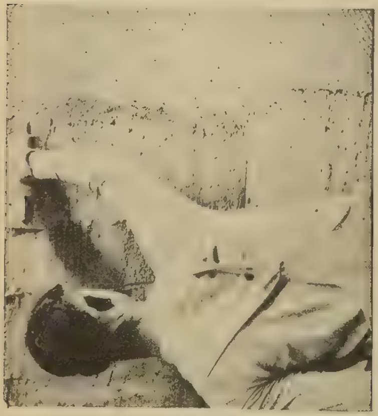

2. Full upward placing

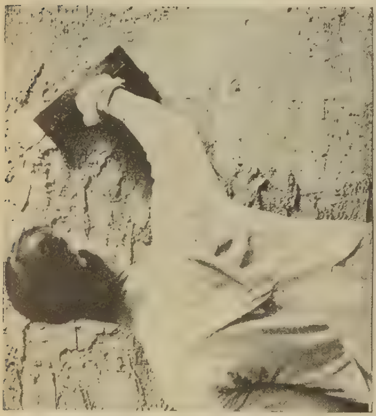
3. Preliminary finish

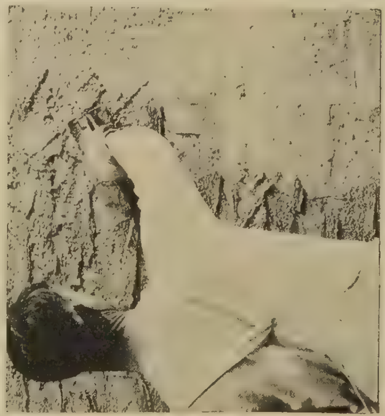

4. Lightly torn surface

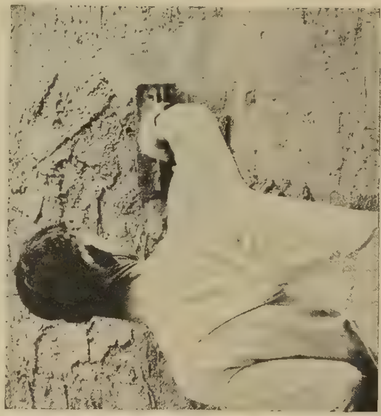

5. Heavily torn finish

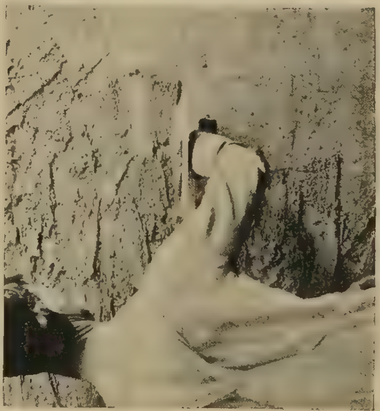
6. A tapestry finish

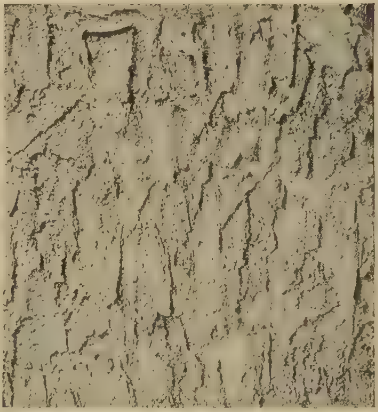

1. Applying thin backing coat


2. Feathering with square trowel


3. Pinched off in all directions

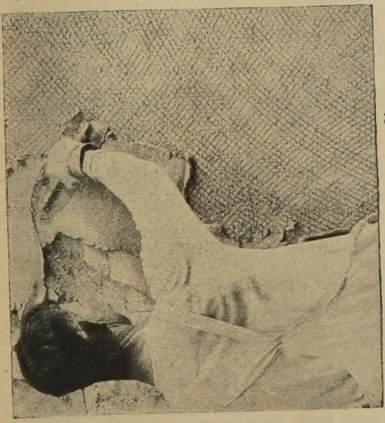

4. Twisting, feathering application

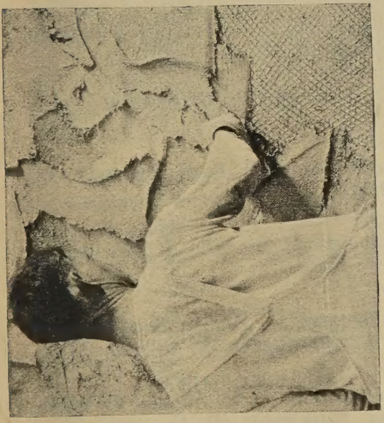

5. Showing small trowel of mortar

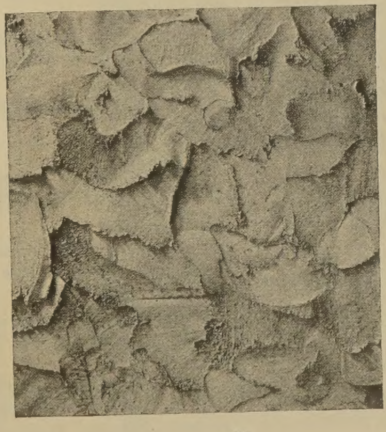

6. A fine, leaflike finish

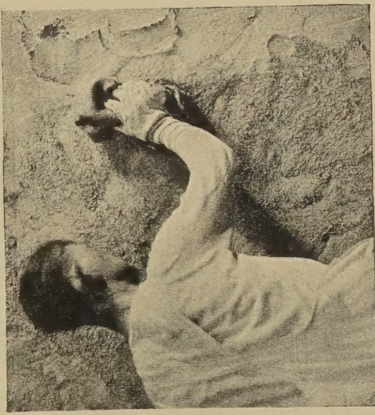
Right, the modern American texture, and left, the English Cottage type

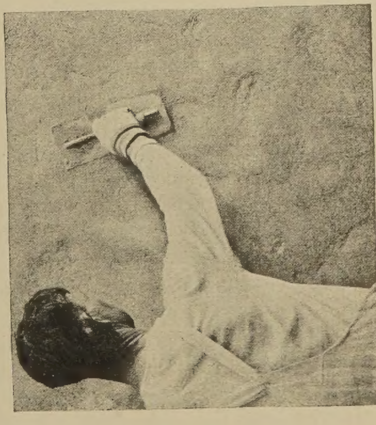
With Portland Cement Stucco

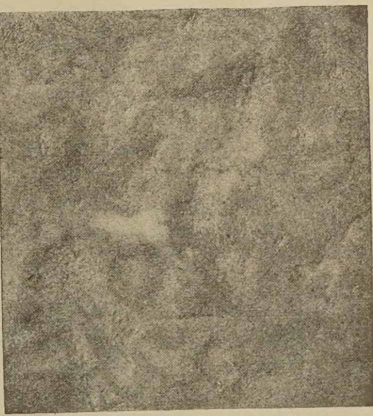

1. Full sweep spreading

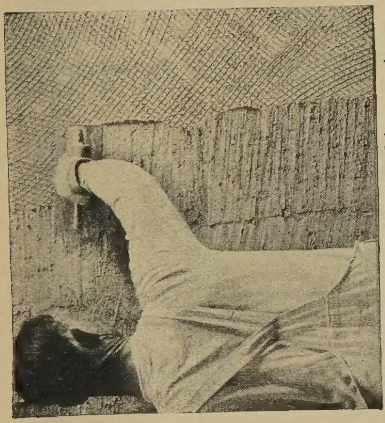

2. Creating the texture

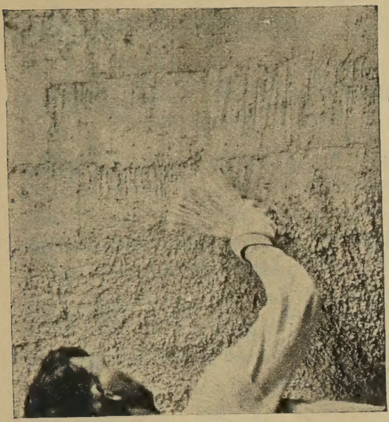

3. Preliminary appearance

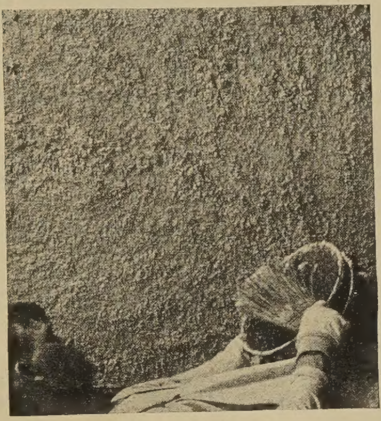

4. Rubbing with burlap

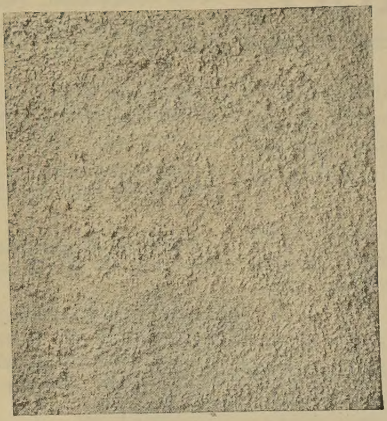

5. Troweling high points

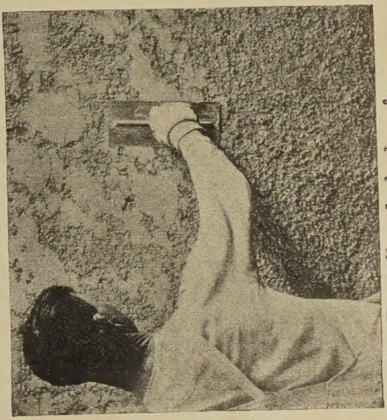

6. A rubbed troweled finish

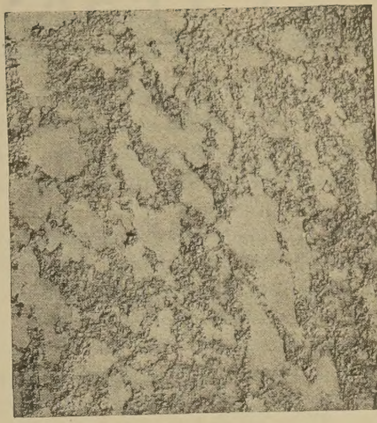

1. Applying thin backing coat


2. Spatter-dash application


3. Method of holding bucket


4. Spatter-dash finish


5. Troweling dashed surface


6. A troweled, spatter-dash finish

Methods of applying, right, the Italian, and left, the Californian, textures are shown

The Concrete Industry
—25 YEARS AGO

IT was just 25 years ago that the first Uniform Specification for portland cement was adopted by the American Society for Testing Materials. *The Cement Age* for December, 1904, comments on this important action as follows:—

"At the last meeting of the Executive Committee of the American Society for Testing Materials, the letter ballot on the Uniform Specification, which has recently been approved, was formally presented.

"The canvass of the vote was 110 in favor of the adoption to 4 against. The Committee thereupon declared the specification adopted and ordered it sent out to the membership. This marks the culmination of several years' work of the Joint Committee, composed of representatives of the Institute of Architects, the American Railway and Maintenance of Way Association, the American Society of Civil Engineers, the American Society for Testing Materials and the Association of American Portland Cement Manufacturers, who have been working on this subject. It forms a backbone upon which it is hoped that specifications for American portland cement will hereafter be modeled.

"Of course, no specification when first prepared is perfect, but represents mutual concessions and compromises. At the same time both consumers and manufacturers realize the importance of a standard and a starting point, and this it is hoped the present specification will stand for.

"In this connection, the Engineering Standards Committee of Great Britain has just published its final report. This report was made by a joint committee, very much along the same lines as that above referred to, though the membership was not that of scientific associations, but of individuals representing consumers, experts, engineers, manufacturers and large contractors in their individual capacity.

"This specification, in many of its details, is similar to the one just adopted in this country, and it is hoped that out of these two standard specifications a universal specification will grow, which will become general in all cement-consuming countries of the world."

—‡—

ANOTHER editorial in the same issue comments on the proposed specifications for mixing and placing concrete then being formulated by the German technical societies. The provision that the "contractor place his works in the hands of a personnel, well experienced in the act of constructions in reinforced concrete, that the workmen must be well experienced and under the constant supervision of skilled technical engineers, and that, upon request, the contractor must give full satisfaction as to the competence of his working force, and mention the works which they have already taken," was endorsed.

The editorial continues: "Steps of this kind are certainly steps in the right direction, for most failures in concrete are not likely to result from improper design but from lack of supervision and watchfulness on the part of those charged with the examination of the work."

—‡—

TALKING about the volume of construction in prospect, the December, 1904, issue of CONCRETE comments on the projected Chicago subway. Cement manufacturers are still trying to land the order.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.

Annual convention, February 11th, 12th and 13th, Roosevelt Hotel, New Orleans, La.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth St., New York City.

American Road Builders' Association; Miss E. A. Birchland, Secretary, 29 W. Thirty-ninth St., New York City.

Twenty-seventh annual convention and road show, January 11th to 18th, 1930. Atlantic City, New Jersey.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Cast Stone Institute; Frank M. Brooks, Secretary, P. O. Box 417, Pasadena, Calif.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Iowa Concrete Products Association; R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Association of Builders' Exchanges; Earl F. Stokes, Secretary, 15 E. Fayette St., Baltimore, Md.

National Concrete Products Association; A. G. Swanson, Secretary, Omaha, Nebr.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; W. P. Hews, Yakima, Wash.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

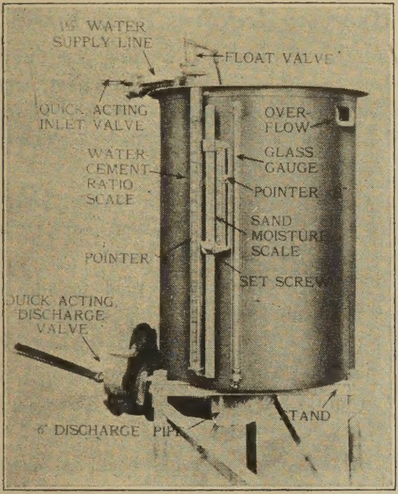
Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin. Annual meeting, January 29th and 30th, Milwaukee.

New Equipment and Materials

New Blaw-Knox Water Measuring Tank

The Blaw-Knox Company, Pittsburgh, Pa., has perfected a water measuring device for control of the water-cement ratio in the mixing of concrete. This device is known as the Blaw-Knox water-cement ratio measuring tank, and it is designed to be used with mixers of 1, 2 and 3 cu. yd. capacities; also intermediate sizes.

The tank is made in two styles—manual and automatic. Both are open top tanks and are equipped with calibrated scales on the outside of the tank, and water gauge glasses showing the level of water in the tank at all times.



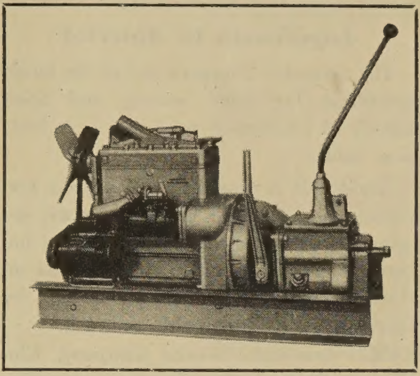
In both the manual and automatic tanks the amount of water measured out for each batch is visible at all times. The calibrated scales are of brass to prevent corrosion.

Industrial Power Unit Has Four Speeds

The accompanying illustration shows the 4 cylinder Model BC, 6 to 10 hp. industrial power unit with variable speed transmission, which is a product of the Fuller & Johnson Manufacturing Co., Madison, Wis. It has three speeds forward and one reverse.

The manufacturer suggests its use for operating industrial trucks, small excavating machines, conveyors, and other similar jobs were variable speed is essential. The model can be equipped with a small transmission for use where continuous operation in first or second gear is not required. It is equipped with an electric starter of the automotive type.

The fully enclosed dry disc type clutch is mounted on the main shaft operated at engineer speed. The clutch can be equipped with hand lever or foot pedal, it is said.



The generator charges the 6-volt battery which supplies current for the starting motor and also for lights on the machine.

New Half-Yard Mixer by Smith

The T. L. Smith Company, independent division of the National Equipment Corporation, are now introducing a new 14-S non-tilting mixer said to be unusually simple in construction and fast in operation.

The drum is of typical Smith design, bigger in diameter and narrow, with 10 deeper full-width discharge buckets and bigger drum openings. It is claimed that these drum improvements permit the use of a wider-throated skip and wider discharge chute—time-saving features that assure quicker loading and faster discharge.

Complete front end operation is provided, with both charge and discharge sides of the mixer visible. The drum rollers are equipped with oversize Timken Bearings in dust-tight housings.

Features of New Stepanian Mixer

For the mixing and transportation of premixed concrete has been designed the Stepanian mixer, which discharges the entire contents in forms or hoppers 7 ft. high or chutes concrete 15 ft. in diameter from the discharge point of belt, it is claimed.

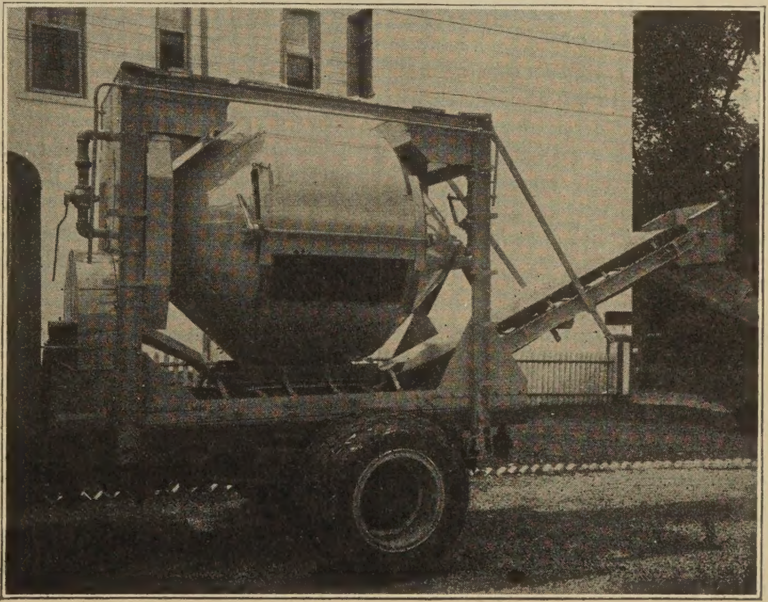
The belt conveyor has a capacity of 2 cu. yds. per minute, and is adjustable to discharge at different heights. The conveyor operates while the truck is in motion, which, together with a long pivoted discharge chute, makes for flexibility in placing.

The drum is designed with a short cylinder center section with frustum ends, for homogeneous concrete, and mixes with a figure 8 motion, for speed.

Water, contained in a tank easily applied or detached, is supplied at both ends of the cone, to effect the most rapid and uniform mixture.

The mixer is said to be mechanically simple, with gears always in mesh. One level in the cab operates all mechanisms. Ten horsepower is said to be the maximum required and is applied uniformly and without high torque.

The mixer is designed by S. Stepanian, of the Arrow Sand and Gravel Company, Columbus, Ohio.



About Makers of Equipment and Materials

INDUSTRIAL LITERATURE

Truscon Fabric for Structures Described

A special booklet just published by the *Truscon Steel Company,* Youngstown, Ohio, contains a general description of Truscon welded steel fabric, recently made available in sizes and weights suitable for general reinforcing work. Tables of standard types and sizes, properties of the wire used and sectional areas of the fabric, allowable load capacities for floor slabs of various spans, a tentative schedule of specifications for reinforced concrete sewer pipe, and tables for estimating weight per hundred square feet of welded steel fabric, are found in it.

It is expected that this new product will be used in the construction of docks, bridges, levees, floor slabs, reservoirs, driveways, sewers, subways, stadiums, viaducts, flues, grandstands, pipe, sidewalks and seawalls. It has been standard reinforcement for concrete highways in many states for several years, according to the Truscon Company.

The booklet cites recognition of welded steel fabric by the New York City building code which allows stresses about 25 per cent higher when welded steel fabric is used as floor reinforcement. It also contains descriptions of Truscon road forms, curb bars, rib reinforcing bars and other Truscon concrete reinforcing products.

Folder Tells How to Get Early Strengths

From the *Alpha Portland Cement Company,* Easton, Pa., comes a small, eight-page modernistic folder entitled *"Alpha Cement and high early strength concrete."* It describes very briefly conditions upon which early and ultimate strengths of concrete depend and pictures steps in its making.

Lone Star Bulletin Shows Recent Uses

The International Cement Corporation bulletin for August on typical uses of *Lone Star cement* describes by word and picture five structures recently erected in which the product was employed. Some space is also devoted to a brief description of the new Washington, D. C., warehouse facilities.

Lapidensin in America

The extensive European use of the liquid protection for stone, stucco, and brick known as *Lapidensin* is shown in a four-page folder.

Lapidensin is described as a process preventing physical and chemical decay, developed in 1929 and used in numerous important structures since. It is applied on stone in temperatures above 45 deg. by spraying or painting with a brush.

The American Fluresit Company, Cincinnati, Ohio, is the American manufacturer of the product.

P T L Inspection

A comprehensive brochure outlining the professional service and facilities it offers has just been published by the *Pittsburgh Testing Laboratory,* Pittsburgh, Pa.

It pictures views of the chemical division, the physical testing division, describes instances where its services were employed and where they should have been used, and gives a list of structures on which it has rendered inspection service.

A map accompanied by views of the branch offices and laboratories shows the *PTL* net work with which it embraces the country.

Roofing Tile Folder

A new, six page folder published by the *L. Hansen Company,* Kansas City, Mo., deals with the *U. S. Champion* concrete roofing tile machine.

A few installations and machines are illustrated and some of the many types and styles described. The tile produced by the machines measure 9 in. by 15 in. long. Holes are made automatically for the purpose of fastening the tile securely to the roof construction by nails or wire, so that they may be said to be absolutely storm-proof. They are made in any color desired in plain colors and in tapestry.

About Pardee Dam

In several ways unusual, *"The Story of the Pardee Dam"* describes this California project and illustrates it with a number of good construction views. It is out of the ordinary in that it reproduces likenesses of the men who were "the guiding minds of the East Bay Municipal Utility district whose vision and management made the Big Project Possible." These include the chief construction engineer, chief engineer and general manager, president of the district, chief designing engineer, and the division engineer.

The publication is outstanding also for its elaborate presentation of the story, and is one of the recent leaflets prepared by the *Calaveras Cement Co.,* San Francisco, Calif.

NOTES FROM THE FIELD

Ryerson Acquires Penn-Jersey

Joseph T. Ryerson & Son Inc., have purchased the business, equipment, and stock of the *Pennsylvania-Jersey Steel Co.* of Camden, New Jersey, effective November 16th.

Complete stocks of steel shapes, plates, sheets, hot and cold finished bars, reinforcing bars, etc., are carried.

The Ryerson Company plan to add to the stock and increase the facilities in order to improve and extend the service.

Arthur C. Allshul, formerly manager of the Buffalo plant of Joseph T. Ryerson & Son Inc., has been appointed manager.

Clarence S. Gedney has been appointed manager of the Buffalo plant succeeding Mr. Allshul. Mr. Gedney has been connected for many years with the specialty sales division of the Ryerson business in the Chicago territory.

American Hoist Representative

The American Hoist & Derrick Company, St. Paul, Minnesota, announces the appointment of *A. R. Gelinas* as its agent for Ontario, Quebec and the Maritime Provinces. His office in Montreal is located in the McRitchie & Black Bldg., 1434 St. Catherine St. West, Montreal, Que., Canada.

Bartlett & Snow Manager in Cleveland

Lloyd R. Wilson, formerly with the Lakewood Engineering Company, Cleveland, is now associated with the *C. O. Bartlett & Snow Company,* Cleveland, as manager of sales of Bartlett-Snow truck bodies for transporting ready mixed concrete.